THE
DESCRIPTION
AND VSE OF THE
SPHAERE.

Deuided into three principall Parts.

WHEREOF
The firſt intreateth eſpecially of the Cir-
cles of the vppermoſt moueable SPHÆRE,
and of the manifold vſes of euery one
of them ſeuerally.
The ſecond ſheweth the plentifull vſe of the
vppermoſt Sphære, and of the Circles
thereof joyntly.
The third contayneth the Deſcription of the
Orbes whereof the Sphæres of the Sunne and
Moone haue beene ſuppoſed to bee
made, with their Motions
and Vſes.

By EDVVARD WRIGHT.

*The Contents of each Part are more particularly ſet
downe in the Table.*

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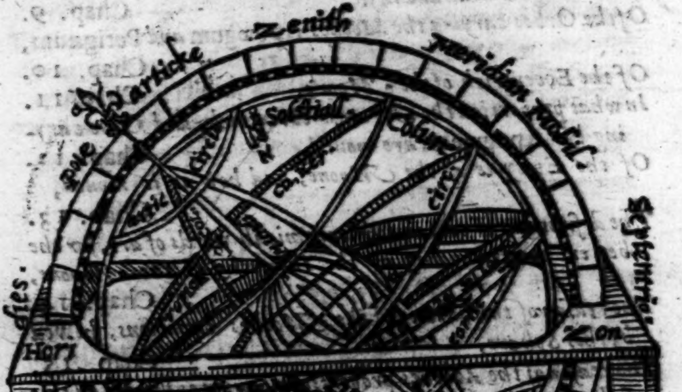
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Whereof this firſt intreateth ſpecially of the Circles of the vppermoſt moueable Sphære and of their peculiar vſes.

CHAP. I.

The definition and diuiſion of the Sphære.

THis Sphære, is nothing elſe but a repreſentation of the Cœleſtiall orbes and circles, that haue beene imagined for the eaſier vnderſtanding, expreſſing, and counting of the motions and appearences, eyther common to the whole Heauens, or proper to the Sunne and Moone.

The circles of this Sphære are eyther inmoueable, as the two greateſt and vtmoſt circles, the Horizon and Meridian, (whereto is adioyned the little houre circle that is fixed to the Meridian) or elſe moueable, as all the reſt contayned within theſe.

CHAP. II.

The Deſcription of the Horizon.

THe greateſt and vtmoſt circle of the Sphære that lyeth leuell on all ſides from the ground, is called the Horizon, which is deuided into 7. limbs, or borders. The firſt and vtmoſt of them conteyneth the 32. points of the Compaſſe, or the windes (as they are at this day deuided and vſed by Sea-men) with their Latine names adjoyned vnto them. The ſecond limbe conteyneth the names and diuiſions of the 12. Windes as they were wont to bee deuided in old time. The third is deuided into the moneths and dayes of the new Kalender, firſt eſtabliſhed by Pope GREGORIE the xiii. and now vſed in many places beyond the Seas. In the fourth limbe are ſet downe the moneths and dayes of the ordinarie Kalender vſed in *England*. Next within this, are placed the 12. Signes and degrees of the Zodiacke, that ſo the place of the Sunne might bee preſently knowne for any day of the yeare giuen, or contrariwiſe, that the day of the Moneth might be readily found by the place of the Sunne. After this, followeth the ſixt limbe conteyning the 32. Windes or points of the Compaſſe, with letters repreſenting the names now in vſe amongſt Engliſh Marriners. The ſeuenth and laſt limbe next the innermoſt edge of the Horizon, is deuided into 360. degrees with figures ſet to euery tenth degree, beginning from the points of Eaſt and Weſt, and ending at North and South; that ſo the number of any degree of the Horizon might bee the eaſilier knowne. Which Circle appeareth moſt plainely to them that are in a plaine Champion Countrie, or vpon the Sea cloſe by the water in a cleare calme day.

Chap. III.
The vſes of the Horizon.

1. IT deuideth the vpper and viſible part of the Heauens from the nether halfe that is hidden out of our ſight.

2. It ſheweth partly the difference of a right and oblique Sphære, for when this circle and the Equinoctiall, croſſe each other at the right Angles, it is ſaid to be a right Sphære, otherwiſe when they make oblique Angles one with another, it is called an oblique Sphære.

3. In an oblique Sphære this circle ſeuereth thoſe Starres which neuer riſe nor ſet, but are alwayes eyther aboue or beneath the Horizon, from ſuch Starres as riſe and ſet in euery 24. houres. For all the Northerly ſtarres that are no further diſtant from the North pole, then the North pole is from the Horizon, doe neuer ſet, but are alwayes aboue the Horizon: And contrariwiſe, thoſe Starres that bee about the South pole, no further diſtant from it then it is from the Horizon, doe neuer riſe, but are alwayes hidden out of ſight vnder the Horizon.

4. In reſpect of this circle, the Sunne, Moone and Starres, or any other part or point of the Heauens, are ſayd to riſe or ſet: For when they come vp from vnder the Horizon, they are ſayd to riſe; otherwiſe when they goe from aboue the Horizon downe vnderneath the ſame, they are ſayd to ſet.

5. And hereof it commeth that the aſcendent, and deſcendent are found by this Circle: for that part of the Ecliptick that is at the Eaſt part of the Horizon ariſing, is the Aſcendent; and the point oppoſite to this at the Weſt part of the Horizon, may be called the Deſcendent.

6. This Circle partly ſheweth the difference of aſcention of any part or point of the Heauens.

7. In this Circle we reckon how farre the Sunne, the Moone, or any Starre, or point of Heauen, ariſeth from the point of due Eaſt.

8. The Horizon determineth the time of the artificiall day and night: for we call the time wherein the Sunne abideth aboue the Horizon, an artificiall day: And the time that he continueth vnder the Horizon, is the artificiall night.

9. This Circle ſheweth the reaſon of the equality of artificiall dayes and nights, in a right Sphære: and of the inequality of them in an oblique Sphære. For in a right Sphære, the Horizon deuideth all the paralels of the Sunne or Circles of the naturall dayes, into equall parts: But in an oblique Sphære, it deuideth them into vnequall parts.

10. By meanes of this Circle, wee know what Starres, and what Eclipſes, Coniunctions, or other aſpects of the Planets may bee ſeene in our Hemiſphere at any time.

11. From the Horizon is meaſured the twilight: For in the morning the Sunne being vnder the Horizon about 18. degrees of the verticall Circle, the twilight beginneth: And when the Sunne is ſo much vnder the Horizon at Euening, the twilight endeth.

12. This Circle is of eſpeciall vſe in Geography, for from it wee begin to account the eleuation of the Pole, and of the Equinoctiall circle, whereby the Latitude of any place is knowne.

13. In Aſtrologie for erecting a figure, this Circle ſheweth the beginning of the firſt and ſeauenth Houſes.

CHAP. IIII.

The deſcription of the Meridian.

Next the Horizon, ſucceeds the Meridian ſtanding vpright on edge, and croſſing the Horizon at right angles in the points of North and South. This circle is diuided on both ſides at the inner edge into 360. Degrees, with figures ſet to euery tenth degree, beginning at the Equinoctiall, and ending at the Poles with 90. and beginning alſo at the Poles, and ending at the Equinoctiall with 90. The numbers beginning at the Pole, ſerue to ſet the Sphære readily to any eleuation deſired. The other numbers beginning at the Equinoctiall, ſhew preſently the declination of any degree of the Zodiacke, or of any point aſſigned in the Sphære, one quarter of the Meridian on eyther ſide thereof from the Equinoctiall to both Poles, ſheweth the Climates, and the quantities of the longeſt dayes.

CHAP. V.

The vſes of the Meridian.

1. It deuideth the World into two halfes or Hemiſphæres: that is, the Eaſt and the Weſt hemiſphæres. The Eaſterly hemiſphære is all that

part of the world which is on the Eaſt-ſide of the Meridian, and the other halfe may bee called the VVeſt hemiſphære.

2. It ſheweth the North and South parts of the world, for the two interſections of the Meridian with the Horizon, ſhew the very points of North and South. The South point is that which is directly vnder the Sunne at noone: And the point right ouer againſt this, is called the North-point.

3. It deuideth the arches of the Equinoctiall, and of all his Paralels, into two equall parts both aboue and beneath the Horizon.

4. And therefore it deuideth the artificiall Day and Night into two equall parts.

5. And conſequently, it ſheweth midday and midnight.

6. In an oblique Sphære it ſerueth in ſtead of a right Horizon (that is) an Horizon that maketh right angles with the Equinoctiall.

7. Therefore the Aſtronomers begin their account of times (which are meaſured by the equall motion of the Equinoctiall) from the Meridian: the principall of which times, is the naturall day which is vſually begun from midday, or midnight.

8. This Circle ſheweth the higheſt and loweſt heights of the Sunne and Starres, which is moſt manifeſt in thoſe Starres that are alwayes aboue the Horizon. Theſe heights are called the Meridian altitudes of the Sun or Starres, which heighes are chiefely obſerued by Aſtronomers and Nauigators with great diligence.

9. In this Circle, wee obſerue the diſtance of the Tropickes, and the greateſt obliquitie of the Zodiacke.

10. In this Circle, wee obſerue and count the Latitudes of places, the height of the Pole, and of the Equinoctiall. For the height of the Pole or Equinoctiall, is nothing elſe but the arch of the Meridian contained betweene the Pole or Equinoctiall and the Horizon. The height of the Pole is alwayes equall to the Latitude of the place. The height of the Equinoctiall is equall to the Complement of the Latitude, and therefore it being ſubſtracted out of 90. there ſhall remaine the height of the Pole.

11. The Meridian ſheweth the longitudes of places in Geographie.

12. In the Meridian, are meaſured the bredth of the Zones and Climates.

13. This circle in Aſtrologie, ſheweth the higheſt and loweſt parts of Heauen, which are the beginnings of two principall Houſes: that is, the fourth and the tenth houſes.

CHAP. VI.

The deſcription of the Houre-circle, and Poles.

THe little Circle faſtned to the Meridian, is called the Houre-circle, which is deuided into 24. equall parts, ſignifying and repreſenting vnto vs ſo many equall houres, whereof both the twelfth houres are fixed iuſt vpon the Meridian, becauſe when the Sunne commeth to the Meridian, it is iuſt twelue a clocke: the vpper XII. ſerueth for the Day, and the other XII. beneath ſerueth for the Night.

The Index, or the Pointer in forme of an Arrow, faſtned vpon the Pinne that commeth through the midſt and Center of this circle, is made to ſhew and point out the ſaid houres as need ſhall require, in the vſe of the Sphære.

The vſe of this houre Circle ſhall be ſhewed hereafter, when we ſhall ſpeake of the common vſe of many circles of the Sphære together. And theſe two Circles (that is, the Meridian and Horizon) are called immoueable, becauſe they keepe themſelues alwayes, and in all places ouer the ſame parts of the Earth; whereas all the reſt (conteyned within theſe two) moue round about altogether with one motion in the ſpace of foure and twenty houres.

This motion (being common to the whole Heauens) is made about two Points or Poles, repreſented in this Sphære, by the two Wyre pinnes about which the Sphære is turned; whereof the one that commeth through the middeſt of the little Circle faſtned to the Meridian (which wee call the houre Circle) repreſenteth vnto vs the Pole Articke or the North Pole: the other becauſe it is oppoſite to this, is called the Antartick pole, that is the right oppoſit, to, or right ouer againſt the North pole, which is alſo the South pole.

CHAP. VII.

Of the Equinoctiall Circle.

Why this Circle is called the Equinoctiall or Equator.

THat Circle which compaſſeth about the midſt of the Sphære, and is euery where of equall diſtance from both Poles, is called the Equinoctiall circle, or the Æquator; either becauſe it is equally diſtant from both Poles of the world; or elſe becauſe the Sunne comming vnder this Circle maketh equality of dayes and nights throughout the world.

It is deuided at the vtmoſt edge, on both ſides thereof into 360 Degrees, with figures ſet to euery tenth degree, beginning at the beginning of *Aries*, and proceeding Eaſtwards, till you be come about to the ſame point againe.

This Circle hath many vſes.

1. It is the meaſure of the firſt motion. For this onely amongſt all the Circles of the Sphære is moued equally both in a right and oblique Sphære, becauſe it alone being perpendicular to the Axtree of the world, about which the Sphære is equally turned, is deuided into two halfes by euery Horizon in the ſame points.

2. It is the meaſure of time; becauſe it meaſureth the quantitie of the artificiall and naturall dayes, of which Moneths and Yeares are made: It meaſureth alſo the quantitie of Houres and of other times which the Sunne maketh going vnder the Zodiacke. And therefore the degrees of the Equinoctiall are called *tempora* (that is) times.

3. It ſheweth the two Equinoctiall points in the Eclipticke, cutting the Ecliptick in two places; which are the beginnings of *Aries* and *Libra*: and the Sun when hee commeth to thoſe two points, is equally diſtant from both Poles of the World, and maketh equalitie of dayes and nights in all places; which hapneth in our time about the 10. or 11. day of March, and the 13. or 14. of September.

4. The irregularitie of the Zodiacke, and of all

the Signes and degrees thereof, is meaſured by this Circle. For ſeeing the moſt part of the apparences of the firſt motion are referred to the Zodiacke, which is not turned about his owne Poles, but about the Poles of the Sphære, and therefore muſt needs bee vnequally turned about; it was needfull that this inequalitie ſhould be ruled and meaſured by ſome other equall motion.

5. It deuideth the Sphære into two halfes (which they call Hemiſphæres) that is, into the North halfe or hemiſphære, wherein is the North pole, and into the South hemiſphære, wherein is the South pole.

6. So it deuideth the Zodiacke into the North halfe, and the South halfe; or into the North ſignes, and the South ſignes.

7. From this Circle are numbred the declinations of the Starres, and of the degrees and parts of the Eclipticke, and of any other point of Heauen.

8. And in this Circle are counted the right aſcentions of the ſame Degrees and Starres, &c. For the right aſcention of any ſtarre or point of the Heauens, is nothing elſe but the Arch of the Equinoctiall circle contained betweene the beginning of *Aries* and the Meridian, the ſame Starre or point being firſt brought vnder the Meridian.

9. In the Equinoctiall is counted the aſcentionall difference and the oblique Aſcention and Deſcention of any point of Heauen. And from the ſame Circle is reckoned the diſtance of the Sunne riſing from the true Eaſt point. For the oblique aſcention or deſcention is nothing elſe but the arch of the Equinoctiall, contained betweene the beginning of *Aries*, and that

point of the Equinoctiall Eaſtwards, which ariſeth or ſetteth together with the Starre or point that is giuen, in an oblique Sphære. And the difference aſcentionall or deſcentionall is nought elſe but the arch of the Equator, whereby the right and oblique aſcention or deſcention of a Starre, or any other point in Heauen doe differ each from other. The diſtance of the ſunnes riſing from the true Eaſt point (which in Latine is called *Amplitudo ortiua,*) is the arch of the Horizon contayned betweene the Equinoctiall and the paralell of the Sunne, or his Center when he riſeth.

10. In Geographie wee count the Longitudes of places in this Circle; and from it we reckon the Latitudes, in the Globe of the earth, and in Maps, and ſea Charts. For the longitude of a place is nothing elſe but the arch of the Equinoctiall circle contayned betweene two Meridians, whereof one goeth by the *Canary* Ilands, and the other by the place that is giuen. And the latitude of a place is the arch of a Meridian contayned betweene the Equinoctiall, and the Zenith of the place that was giuen.

11. In Dialling this Circle is of eſpeciall vſe. For by meanes of it the ſpaces of the houres are deuided in all kindes of Dials, horizontall, erect, direct, declining, inclining, reclining, &c.

12. In Aſtrologie the twelue Houſes are ſet out by the equall diuiſions of this Circle into twelue parts, according to the way deuiſed by *Regiomontanus*, which way is commonly called rationall or reaſonable. And this Circle gouerneth the directions, whereby things to come are artificially fore-told.

CHAP. VIII.

The deſcription of the Zodiacke.

THe great broad Circle that compaſſeth about the Sphære obliquely, comming nearer the Pole of the Sphære in one place then in another, is called the Zodiacke.

Round about through the middeſt of this Circle, is drawne the Circumference commonly called the Eclipticke line, deuiding the whole Sphære, and the whole bredth of the Zodiacke throughout, into two equall parts.

In this Sphære there are repreſented vnto vs two Eclipticke lines. The one may be called the middle, or fixed Eclipticke, which keepeth alwayes the ſame diſtance or obliquitie from the Equinoctiall. The other may bee called the true or moueable Eclipticke, becauſe it maketh not alwayes the ſame angles of interſection with the Equator, but ſometimes greater, ſometimes leſſe. For the greateſt obliquitie of the Zodiacke, which not long before *Ptolomees* time was obſerued to bee 23. Degrees and 52. Minutes; in *Copernicus* his time, was hardly found to exceed 23.degrees 28. minutes, according to his obſeruation, and therefore hee thought that the difference betweene the greateſt and leaſt obliquitie of the Zodiacke, was 24. Minutes: and the middle or meane obliquitie betweene both theſe, to bee 23. Degrees 40. Minutes.

The manner of the variation of this obliquitie may in ſome ſort bee ſhewed by this Sphære, if we ſuppoſe the fixed Eclipticke drawne round about through the middeſt of the Zodiack to be 23. degrees 40. min. diſtant from the Equinoctial at the beginning of *Cancer* and *Capricorne*: and the moueable Eclipticke (faſtned as it were vpon two Poles at the beginning of *Aries* and *Libra*, and ſo hauing alwayes the ſame points of interſection with the middle Eclipticke and Equinoctiall) to bee moued vp and downe aboue and beneath the middle Eclipticke, by the ſpace of 12. Minutes at the beginning of *Cancer* and *Capricorne*: and this motion to finiſh his reuolution once in 3432. Iulian yeares.

The bredth of the Zodiacke is bounded by the greateſt latitudes of the Planets, eſpecially of *Venus* and *Mars*, which ſometimes hath almoſt 7. degrees of latitude.

The Zodiacke is diuided by the Equinoctiall into two ſemicircles.

The one aboue the Equinoctiall is called the Northerly ſemicircle: the other halfe beneath the Equinoctiall, is the Southerne ſemicircle of the Zodiacke.

So long as the Sunne moueth vnder the firſt of theſe ſemicircles, the dayes are longer then the nights, otherwiſe they are ſhorter.

Each of theſe ſemicircles is againe deuided into two parts, and ſo the whole Zodiack into foure quarters: the firſt from *Aries* to *Cancer*, may be called the vernall or Spring-quarter, which in this Sphære is alſo ſhewed by the word *Ver* (ſignifying the Spring:) The next from *Cancer* to *Libra*, the Summer quarter, wherein is written the word *Aeſtas* ſignifying the Summer. The 3. from *Libra* to *Capricorne*, is the Harueſt quarter, wherein you ſhall finde in this Sphære the word *Autumnus* which ſignifieth Autumne or Harueſt. The fourth and the laſt, from the beginning of *Capricorne* to *Aries*, is called the winter Quarter, which in this Sphære is ſhewed by this word *Hiems*, which ſignifieth the Winter. And theſe foure quarters of the Zodiacke are thus called by the names of the Quarters of the yeare, becauſe the Sunne mouing vnder thoſe quarters of the Zodiacke, maketh thoſe foure Quarters of the yeare. Euery one of theſe quarters of the Zodiacke is againe deuided into three parts, and ſo the whole compaſſe of the Zodiacke into 12. which are called the 12. Signes, whereof euery one contayneth 30. Degrees in length from Weſt to Eaſt, and is in bredth equall to the bredth of the Zodiacke. Theſe Signes, and the Zodiacke it ſelfe haue their beginning from that common meeting, or croſſing of the Eclipticke, and the Equinoctiall, where the Eclipticke beginneth to ariſe aboue the Equinoctiall towards the North pole: and they are called by theſe names; *Aries*, *Taurus*, *Gemini*, *Cancer*, *Leo*, *Virgo*, *Libra*, *Scorpio*, *Sagittarie*, *Capricorne*, *Aquarie*, *Piſces*. That is to ſay, The Ramme, the Bull, the Twinnes, the Crab, the Lyon, the Virgin, the Ballance, the Scorpion, the Shooter, the Goat, the Water-pourer, the Fiſhes. And they are ſignified by theſe Characters, ♈, ♉, ♊, ♋, ♌, ♍, ♎, ♏, ♐, ♑, ♒, ♓. This deuiſion of the Zodiacke into 12. Signes and of euery ſigne into 30. Degrees, nature it ſelfe ſeemeth to haue ſhewed by the motions of the Sun and Moone. For in what time the Sunne moueth once about the whole compaſſe of the Zodiacke, the Moone maketh twelue reuolutions through the ſame. Therefore as the time of a yeare is deuided into 12. Moones, ſo the Zodiacke is deuided into 12. Signes. And as euery Moneth contayneth 30. dayes, ſo euery ſigne is deuided into 30. parts, which they call Degrees, which ſignifieth as much as ſteps, becauſe the Sunne ſteppeth, or goeth forwards almoſt ſo much as a degree in euery day, from the Weſt Eaſtwards vnder the Zodiacke.

The Zodiacke is otherwiſe alſo deuided into two ſemicircles, the one (from *Capricorne* to *Cancer*) aſcending, becauſe that ſo long as the Sunne or any of the Planets are in that ſemicircle, they ſtill aſcend and riſe higher and higher aboue the Horizon. The other ſemicircle of the Zodiacke, from *Cancer* to *Capricorne*, is called deſcending, becauſe the Sunne or Planets being in that ſemicircle, come downe euery day lower then other.

The 12. Signes are by the Aſtrologians diuerſly deuided, firſt into chiefe, meane, and common ſignes. The chiefe ſignes (which are alſo called Cardinall, that is the principall ſignes) are *Aries*, *Cancer*, *Libra*, and *Capricorne*, becauſe they come next after the principall points of the Zodiacke, that is, the two Equinoctiall points at the beginnings of *Aries*, and *Libra*; and the two ſolſtitiall points of *Cancer* and *Capricorne*. The meane ſignes (which are alſo called fixed) are *Taurus*, *Leo*, *Scorpio*, and *Aquarius*. They are called meane, becauſe they are placed betweene the chiefe or principall, and the common ſignes. They are called fixed ſignes, becauſe that when the Sunne is in thoſe ſignes, wee finde a more perfect temperature of the Ayre, then when he is in the other ſignes.

The common ſignes (which are alſo called double bodyed) are *Gemini*, *Virgo*, *Sagitarie*, and *Piſces*. They are called common, becauſe they take part of the nature of the fixed ſignes going before them, and of the Cardinall ſignes following after them. They are called double bodied, by reaſon of their Images, as they are imagined in the eight Sphære, which are compounded of two bodies: For there be two Twinnes; and the Virgin holdeth an eare of corne in her hand; *Sagitarie* is made of a Man and an Horſe; and there are two Fiſhes. The placing, and nature of theſe ſignes brought in this diuiſion.

The Aſtrologians alſo deuide the 12. Signes into foure trigons or triplicities, ſo called becauſe they are diſtant the third part of a Circle, one from another. The firſt triplicitie contayneth *Aries*, *Leo*, and *Sagitarius*; and is called the fiery trigon, or triplicitie: The ſecond triplicitie contayneth *Taurus*, *Virgo*, and *Capricorne*; and is called the earthly trigon. The third triplicitie contayneth *Gemini*, *Libra*, and *Aquarius*; and is called the ayrie trigon. The fourth triplicitie contayning *Cancer*, *Scorpio*, and *Piſces*; is called the watrie trigon. Nature it ſelfe is the cauſe of this diuiſion of the Signes alſo. For into theſe Trigons of the ſignes, ſhee hath diſtributed the Coniunctions of the three ſuperiour Planets; eſpecially the coniunctions of *Saturne* and *Iupiter*, which the Aſtrologians call great coniunctions. For examples ſake, if there bee a great coniunction in *Aries*, the ſame ſhall be twenty yeares after in *Sagitarie*, and other twenty yeares after in *Leo*; and after as many more yeares, it returneth againe into *Aries*. The reuolution of one Trigon contayneth teyneth almoſt 200. yeares, after which time the ſame great conjunctions remoue into the next trigon.

CHAP. IX.

The vſe of the Zodiack.

1. THe Zodiack is the meaſure of the ſecond motions, as the Equinoctiall is the meaſure of the firſt motion.

2. For in this Circle wee reckon the longitudes, and from it we count the latitudes of all the Starres. For the longitude of a Starre is nothing elſe but the arch of the Ecliptick conteyned betweene the beginning of Aries, and the circle of the Starres latitude. And the latitude is the Arch of a great circle, drawne by the poles of the Ecliptick, conteyned betweene the Starre and the Ecliptick.

3. According to this circle, the whole Heauen, yea, the whole world is deuided into twelue Signes. Whereof it commeth that becauſe of this Circle, aſwell the fixed, as the wandring Starres which we call Planets, yea, and thoſe Starres alſo that appeare of a ſudden, as blazing Starres or Comets, and other Meteors, are ſaid to be in this or that ſigne, and that three manner of wayes.

Firſt, to be in a ſigne, is to be vnder ſome one of the 12. parts of the Ecliptick. Thus the Starres which are vnder the Ecliptick, but eſpecially the Sunne which runneth alwayes vnder it, are ſaid to be in the Signes.

Secondly, becauſe the Zodiack hath latitude, thoſe Starres are ſaid to be in a ſigne, which although they be beſide the Ecliptick, yet are vnder the Zodiack, and ſo any of the other Planets, which for the moſt part wander beſide the Ecliptick, may be ſaid to bee in ſome ſigne.

Thirdly, if we vnderſtand ſix great Circles to bee drawne by the beginnings of the twelue ſignes, and by the poles of the Eclipticke; by theſe circles the whole heauen (or rather the whole world)is deuided into twelue parts, which with a generall name are called ſignes: Thus all the Starres aſwell fixed as Planets and Comets, which are without the Zodiacke in any of theſe parts, may be ſaid to be in ſome ſigne.

4. In this circle are noted the degrees of the ſignes, with which the Starres doe riſe and ſet, as well in a right as in an oblique Sphære. For becauſe this circle is the chiefeſt, all Cæleſtiall apparances (or at leaſt the moſt part of them) are referred vnto it, and not vnto the Equinoctiall. But the Equinoctiall meaſureth the times of their riſings and ſettings.

5. The obliquitie of the Ecliptick is the cauſe of the inequalitie, aſwell of naturall dayes in both Sphæres, as of artificiall dayes in an oblique Sphære. For ſeeing it is moued vnequally, becauſe it is moued vpon other Poles then his owne, the Sunne which is the author, and maker of times mouing vnder it, muſt needs make vnequall dayes.

6. The chiefe times are defined by this circle, as the time of a yeare, by the motion of the Sunne; the time of a moneth by the motion of the Moone, through the whole compaſſe of this circle. Alſo the foure quarters of the yeare, Spring, Summer, Autumne, and Winter; whereto may be added *Plato* his great yeare, which is the time wherein the fixed Starres make one reuolution about the axtree and poles of the Zodiack,

ack, if God would haue the world to laſt ſo long.

7. The Eclipticke line ſheweth the places, and times of the Eclipſes: For the Sunne and Moone, are Eclipſed onely vnder it, or neere vnto it.

8. As the deſcription of the Tropicks dependeth on the obliquitie of the Eclipticke, ſo the polar Circles are deſcribed by the Poles thereof.

9. Hereof it commeth, that by reaſon of the ſame obliquitie, the Zones and Climats are ſet forth and bounded.

10. This Circle is of eſpeciall vſe in Aſtrologie, for it diſtinguiſheth the points of the 12. Houſes, and in it the Aſpects and configurations of the Planets are obſerued. The chiefeſt judgement aſwell in caſting Figures as in reuolutions and directions is taken from this circle.

CHAP. X.

The deſcription of the two Colures.

THe two circles croſſing each other at right Angles in the poles of the Sphære, are called the Colures: whereof the one that paſſeth by the common meeting of the Eclipticke and Equinoctiall, is called *Colurus æquinoctiorum*, that is the Equinoctiall Colure, or the colure of equall dayes and nights. The other paſſing by the poles of the Eclipticke, and the Solſtitiall points, is called *Colurus ſolſtitiorum*, the Solſtitiall colure, or colure of the Sunne-ſtandings.

Vſes common to both Colures.

1. By meanes of theſe two Colures, all the mouable circles of the materiall Sphære are framed toge-

ther, that ſo they might be turned about, like as the whole Heauens are moued.

2. The Poles are faſtened in the common meeting of theſe two Circles: and the Poles are alſo ſhewed by the ſame common meetings.

3. They ſhew the foure principall points of the Eclipticke; that is, the two Equinoctiall, and the two Solſtitiall points.

4. Theſe circles ſhew thoſe points of the Eclipticke, wherein the Sunne is either equally diſtant from both poles of the Sphære, or commeth neereſt to either of them: In which points the Sunne maketh the dayes longeſt or ſhorteſt, or of a meane length betweene both theſe in an oblique Sphære.

5. They deuide the Ecliptick into foure quarters, in which the Sunne maketh foure quarters of the yeare, the Spring, the Summer, Autumne, and Winter.

6. They deuide the Ecliptick and Equinoctiall into ſuch foure quarters, as in a right Sphære doe riſe together in equall time.

CHAP. XI.

Vſes of the Equinoctiall Colure.

1. THe ſection of this Circle with the Ecliptick, ſheweth the Equinoctiall points, wherein the Equinoctiall and the Eclipticke doe deuide and croſſe each other. In which points the Sunne maketh equality of dayes and nights throughout the whole world: whereof this circle is alſo called *Colurus Æquinoctiorum*; that is, the colure of equall dayes and nights, or the Equinoctiall colure.

2. It deuideth the Eclipticke into the North and South halfes.

3. It deuideth the Signes wherein the Sunne maketh the dayes longer then the nights, from thoſe ſignes wherein the dayes are made ſhorter then the nights.

4. It ſheweth which halfes of the Eclipticke and Equator, doe ariſe together in equall time in an oblique Sphære.

5. It ſheweth the two high *Sunne-ſtandings* in a right Sphære, in the time of which Sunne-ſtandings, the Sunne paſſeth by the Zenith.

CHAP. XII.

Vſes of the Solſtitiall Colure.

1. THe common meetings of this circle with the Ecliptick, ſhew the Solſtitiall or Tropicall points; in which points the Sunne ſeemeth to ſtand, and then returneth backe againe: for which cauſe this circle is called the Colure of the Sun-ſtandings. Theſe points are called tropicall (which is as much to ſay as turne-points, or points of returne) becauſe that when the Sunne going alwayes vnder the Eclipticke commeth to theſe points, which are furtheſt diſtant from the Equinoctiall circle, it returneth againe towards the ſame circle. But they were called Solſtitiall or Sun-ding points, becauſe that whileſt the Sunne is about thoſe points, the difference of the Sunnes returning is (for certaine dayes) inſenſible. Hereof the Sunne is ſaid to make his ſtation, or to ſtand, when he commeth to either of thoſe points. They that dwell without the Tropickes, haue two

ſunne-ſtandings, that is the Summer ſun-ſtanding, or high ſun-ſtanding (when the Sunne in Summer time is at the higheſt, and next vnto our Zenith being in the beginning of *Cancer*) and the winterly, or low ſun-ſtanding, when the Sunne in Winter time is loweſt in the Meridian, and furtheſt from our Zenith. But they that dwell within the Tropicks (by a certaine ſimilitude taken from our ſun-ſtandings, wherein the Sunne is either higheſt or loweſt) are ſaid to haue foure ſun-ſtandings; that is two high ſun-ſtandings, when the Sunne paſſeth by their Zenith (the higheſt point in the Heauens) which hapneth twice euery yeare in two places, equally diſtant from the beginnings of *Cancer* and *Capricorne*: and two low ſun-ſtandings, when the Sunne is in the beginning of *Cancer* and *Capricorne*.

2. In this Circle by the arch conteyned betweene the Equator and Eclipticke, we meaſure the greateſt declination of the Sunne, or obliquity of the Eclipticke, which in *Ptolomees* time was 23. degrees 51. minutes, and one third part of a minute. But euer ſince that time it hath beene found by obſeruation to decreaſe; ſo as in this our age, it is no more then 23. degrees and one halfe, or little more: Notwithſtanding *Copernicus* thought that the greateſt obliquity was 23. degrees 28. minutes.

3. It ſheweth the places of the Eclipticke, in which the Sunne (comming neereſt to our Zenith) maketh the artificiall day longeſt; or going furtheſt from the ſame point, maketh the ſame ſhorteſt.

4. It deuideth the Zodiacke into two halfes, the one aſcending, and the other deſcending.

5. Hereby alſo the ſignes are diſtinguiſhed, which doe riſe rightly, and which riſe obliquely in an oblique Sphære. For the deſcending halfe riſeth rightly, and the aſcending halfe riſeth obliquely.

6. So the points of the Eclipticke are ſhewed by this Circle, wherein the greateſt difference of right and oblique aſcenſions happeneth. It diſtinguiſheth thoſe ſignes in which when the Sunne moueth, the artificiall dayes are increaſed, and the nights decreaſe; from thoſe ſignes wherein the dayes are diminiſhed, and the nights increaſe.

7. In this circle are the bredths of the Zones bounded; for the obliquity of the Eclipticke doubled, ſheweth the bredth of the torrid or burnt Zone: the diſtance of the poles of the Ecliptick, and of the Poles of the Equator, ſhew the bredth of the cold or frozen Zones; and the other two Arches remaining, ſhew the bredths of the temperate Zones.

CHAP. XIII

The Deſcription of the two Tropickes.

THe two ſmaller Circles Equidiſtant in all places from the Equinoctiall, and comming vnder theſe Solſtitiall points of the Eclipticke on both ſides, are called the Tropicks, that is circles of returne.

And they are ſo called, becauſe that when the Sun commeth to them, it beginneth to returne backe againe towards the Equinoctiall circle. Or elſe they may be ſo called, becauſe they are deſcribed by the turning about of the Tropicall points of *Cancer* and *Capricorne*. They are alſo called ſolſtitiall Circles; that is Circles of the ſun-ſtandings; becauſe that by reaſon of the inſenſible alteration of the declination of the Ecliptick for ſome ſpace both before, and after the Tropicall points, the Sunne (in reſpect of his Meridian altitudes, or in reſpect of the motion he hath towards the North or South, by reaſon of the obliquity of the Ecliptick) ſeemeth to ſtand (as it were) for certaine dayes in thoſe places.

There be two Tropicks, the Tropick of *Cancer*, and the tropick of *Capricorne*.

The tropick of *Cancer*, toucheth the Ecliptick in the beginning of *Cancer*, which is the moſt northerly point of the Ecliptick: or it is the Tropick deſcribed in the firſt mouable Sphere, by the Summer ſolſtitiall point.

This circle is called the Tropick of *Cancer*, becauſe it toucheth the Ecliptick in the beginning of *Cancer*.

It is alſo called the Summer Tropick, and the Tropick of the Summer ſun-ſtanding, becauſe that when the Sunne commeth to it, the Summer beginneth. It is called the North tropick, becauſe it is in the North part of the world: and the Circle of the high ſunne-ſtanding, becauſe the Sunne comming to it, is higheſt in the Meridian, and next vnto our Zenith which dwell in the North part of the world, without the Tropicks. The Tropick of *Capricorne* is the Tropick which toucheth the Ecliptick in the firſt point of *Capricorne*. It is called the Tropick of *Capricorne*, becauſe it toucheth the Ecliptick in the beginning of *Capricorne*. It is called the winter Tropicke and Tropick of the Winter ſun-ſtanding, becauſe the Sunne commeth to it in Winter.

It is alſo called the circle of the loweſt Sunne-ſtanding, becauſe that when the Sunne commeth to this Tropicke, it is furtheſt diſtant from our Zenith, and hath his loweſt height in the Meridian.

CHAP. XIIII.

Vſes of the Tropickes.

1. THe Tropicks ſhew the Tropicall, or Solſtitiall points of the Eclipticke: that is, the points wherein the Sunne ſeemeth to ſtand, and beginneth to returne backe againe.

2. They bound out the greateſt declinations of the Sunne, which in our times is about 23. degrees and an halfe.

3. Therefore they doe alſo bound out the obliquity of the Ecliptick, for they are the bounds of the Sunnes way, beyond which the Sunne goeth not at any time.

4. The Sunne comming to either of theſe circles, is either neereſt, or furtheſt diſtant from our verticall point.

5. In an oblique Sphære, they meaſure out the ſhorteſt, and longeſt artificiall day and night.

6. The Tropicks (alwell in Heauen as in Earth, conteyne betwixt them the Torrid Zone, and ſeparate it from the temperate.

CHAP. XV.

The Polar Circles.

THe two ſmalleſt circles that are next about the poles of the Sphære, are called the polar circles. They are drawne by the poles of the Eclipticke, and are euery where Equidiſtant from the Equinoctiall, and from the poles of the Sphære.

They are called polar Circles, either becauſe they are neere the poles of the Sphære, or elſe becauſe they are deſcribed by the motion of the poles of the Eclipticke.

And therefore there be two polar Circles, that is, ſo many as there are poles of the Ecliptick: the Polar circle Artick, and the Polar Antartick.

The Articke polar circle, is that which paſſeth by the North pole of the Ecliptick, or which is deſcribed by the North pole of the Ecliptick being carried about with the motion of the firſt moueable Sphære.

The Antartick polar circle, is that which goeth by the South pole of the Eclipticke, being deſcribed with the firſt motion by the Antartick pole of the Ecliptick.

The diſtance of theſe polar Circles from the poles of the Sphære, is equall to the diſtance of the tropicks from the Equinoctiall, which in our time is about 23.degr. and an halfe: for ſo much as is the obliquity of the Zodiack (whereto the diſtance of the Tropicks from the Equinoctiall is alwayes equall) ſo much are the poles of the Ecliptick diſtant from the Poles of the world.

CHAP. XVI.

Vſes of the Polar Circles.

1. THe Polar Circles ſhew the poles of the Zodiack, and ſhew their diſtance from the poles of the Equinoctiall.

2. The temperate Zones are bounded by theſe

polar circles; for the Articke circle boundeth the North ſide of the North temperate Zone; and the Antartick circle boundeth out the South ſide of the South temperate Zone.

3. The Polar circles ſeparate the temperate Zones, from the cold Zones which they compaſſe round about, and incloſe within them.

Therefore the foure leſſer circles, that is the two Polar circles, and the Tropickes, deuide Heauen and Earth, into fiue Zones.

CHAP. XVII.

Of the Zones.

A Zone is a ſpace of Heauen, or Earth, conteyned betweene two of the ſmaller Circles; or incloſed within the compaſſe of either Polar circle.

They are called Zones (that is as much to ſay as girdles) becauſe they compaſſe about Heauen or Earth like a girdle.

The Zones are deuided by auncient Writers into two kindes; that is into temperate, and vntemperate Zones.

A temperate Zone is the ſpace of Heauen or earth, conteyned betweene either of the Tropicks, and the next Polar circle.

There be two temperate Zones; the one North, the other South.

The North temperate Zone is conteyned betweene the Tropicke of *Cancer*, and the Artick polar circle.

The South temperate Zone is that which is conteyned betweene the Tropicke of *Capricorne*, and the Antartick polar circle.

They are called temperate Zones, becauſe they haue a better temperature of the ayre for the moſt part, and more meet for habitation, then the vntemperate Zones. The bredth of eyther temperate Zone is alwayes equall to the complement of the diſtance of the Tropicks, and therefore in this age is about 43. degrees, that is 2580. Engliſh miles.

There be two kinde of vntemperate Zones, the one exceeding in heat, the other in cold, for the moſt part.

The hot vntemperate Zone, (called alſo the Torrid; that is, the burnt or broyled zone) is that ſpace of Heauen or Earth, which is conteyned betweene the tropicks.

It is called the burnt Zone, becauſe that by reaſon of the Sunnes continuall going ouer that zone, and caſting his beames directly downe thereupon, it is ſcorched with ouer-much heat, and is not ſo meet to be inhabited as the temperate zones.

The bredth of this Zone is alwayes equall to the obliquitie of the Zodiack, or greateſt declination of the Sunne, doubled; which in our time is about 47. degrees, that is 2820. Engliſh miles.

The cold or frozen zones, are the ſpaces of Heauen or earth, conteyned within the Polar circles.

There be two cold zones, the one North, conteyned within the compaſſe of the Articke circle: the other South, conteyned within the compaſſe of the Antartick Polar circle.

Theſe zones exceed in cold, becauſe they want the ſight of the ſunne for a great part of the yeare, and when the Sunne appeareth vnto them, his beames fall ſo obliquely vpon them, that they can (in all likelyhood) receiue but ſmall heat thereby for the moſt part.

The bredth of theſe Zones is meaſured from the Poles of the world to the Polar circles, and therefore muſt alwayes bee ſo much as the Polar circles are diſtant from the Poles: that is, in our age about 23. Degrees and a halfe, which make 1410. Engliſh miles.

CHAP. XVIII.

The difference of Shadowes that the Sunne maketh in theſe Zones.

THey that dwell in the torride Zone, doe caſt their ſhadowes which the Sunne maketh at noone (which we may therefore call their noone ſhadowes) both towards the North, and towards the South: towards the North, when the ſunne is betwixt their zenith and the ſouth point of the Horizon; and towards the South, where the ſunne is betweene their Zenith and the North.

For ſeeing the zenith of them that dwell in that Zone is betweene the Tropicks, the ſunne muſt needs bee ſometimes Northwards from their zenith, and ſo make a ſouth ſhadow: and ſometime Southwards, and then make a north ſhadow. For which cauſe they that inhabite this Zone are called *Amphiſcij*; that is, ſuch as caſt their noone ſhadowes on both ſides.

But they that dwell in the temperate Zones, are called *Heteroſcÿ*; that is, ſuch as caſt their ſhadowes at noone, one way onely. For they that dwell in the North temperate Zone, haue the Sunne alwayes at noone from their Zenith Southwards, and therefore muſt needs alwayes caſt their noone ſhadowes Northwards. Whereas contrariwiſe they that inhabit the South temperate Zone, hauing the Sunne at noone alwayes Northwards from their Zenith, muſt needs haue their ſhadowes at noone, alwayes towards the South.

And they that are in the cold Zones, are called *Periſcÿ*; that is, ſuch as caſt their ſhadowes round about them. For ſeeing the Sunne continueth euery yeare for certaine dayes together, alwayes aboue their Horizon, and therefore moueth round about them without ſetting: it muſt needs bee, that their ſhadowes alſo are carried round about them, falling towards all parts of the world in the ſpace of 24. houres.

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THE

THE SECOND PART.

Of the vſes of the vppermoſt SPHÆRE, and of the Circles thereof joyntly.

PROP. I.

To rectifie the Sphare to the Latitude. &c.

FIrſt finde by obſeruation, or otherwiſe the height of the Pole, or Latitude of that place for which you would rectifie the Sphære. Then (by turning about the Meridian of the Sphære, lift vp or put downe the North Pole of the Sphære (about which the houre circle is faſtened) till the arch of the Meridian from the North part of the Horizon vpwards vnto the Pole, be iuſt ſo many degrees as the eleuation of the Pole or latitude of the place was found to be : for ſo haue you the Sphære duly rectified.

As for example, the Latitude of the Citie of *London* is 51. degrees and 32. minutes, therefore if you lift vp the North Pole of the Sphære, aboue the North part of the Horizon, ſo many degrees and minutes you ſhall haue your Sphære rectified for that place.

PROP. II.

PROP. II.
To know the place of the Sunne;&c.

LOoke the day of the moneth (for which you deſire to know the place of the Sunne) in the Horizon, and ſee what ſigne and degree of the Zodiacke vpon the Horizon anſwereth thereto; for there haue you the place of the Sunne.

Take for example the 25. of December: looke this day therefore in the Horizon, and you ſhall finde anſwerable thereto 13. degrees, and about 40. minutes of *Capricorne*, which is the place of the Sunne at that time.

PROP. III.
To know the declination of the Sunne;&c.

BRing the point whoſe declination you deſire to know, vnto the Meridian of the Sphære, and look what number of degrees and minutes of the Meridian is conteyned betweene that point, and the Equinoctiall, for ſo much is the declination.

As if you would know the declination of the 10. degree of *Taurus*, bring that degree to the Meridian, and you ſhall finde the arch of the Meridian between that degree and the Equinoctiall, to be 14. degrees and about 51. minutes.

PROP. IIII.
To know the right aſcention of the Sunne,&c.

BRing that point (as before) to the Meridian, and ſee then how many degrees and minutes of the Equinoctiall are conteyned betweene the beginning of *Aries* and the Meridian; for that is the right aſcenſion of that point. So you ſhall finde the right aſcenſion of the 10. degr. of *Taurus* to be 37. degr. 35. min. for if you bring that degree of *Taurus* to the Meridian, you ſhall finde ſo many degrees and min. between the beginning of *Aries*, and the Meridian.

PROP. V.

To know the oblique aſcenſion of the Sunne, &c.

SEt the Sphære to the eleuation of the place for which you deſire to know the oblique aſcenſion; then bring the Sunne, Starre, or point whoſe oblique aſcention you would know, vnto the Eaſt ſemicircle of the Horizon, and looke how many degrees and minutes of the Equinoctiall circle, are conteyned between the Eaſt point of the Horizon, and the beginning of *Aries*; for ſo much is the oblique aſcenſion deſired: As for example, if you ſet the Sphære to the Latitude of *London* 51. degr. 32 min. and then bring the 10. degree of *Taurus* to the Eaſt part of the Horizon, you ſhall finde about 19. degrees and an halfe of the Equinoctiall, at the ſame Eaſt part of the Horizon; which is the oblique aſcenſion of that degree of *Taurus*, for the Latitude of the Citie of *London*.

PROP. VI.

To finde the difference of Aſcenſion.

COmpare the right and oblique aſcenſions of the Sunne, (or of any point of the Zodiacke) together, and ſubtract the leſſe from the greater; for the remainder ſhall bee the difference of aſcenſion. As for example, the right aſcenſion of the 10. degree of *Taurus*, being found by the 4. Propo. to be 37. degrees, 35. min. and the oblique aſcention of the ſame degree at *London*, by the 5. Prop. 19. degree 30. min. by ſubtraction of the leſſe out of the greater, the difference ſhall be found to be 18. degr. and 5. minutes, which is the difference of aſcention ſought for.

PROP. VII.

To finde at what time the Sunne riſeth or ſetteth.

REduce the difference of Aſcention into houres and minutes (taking for euery 15. degrees 1. houre, and for euery one degree that remayneth 4. minutes, and for euery minute of a degree 4 ſeconds) for theſe houres, minutes and ſeconds, being added to *6.* houres, if the Sunne bee in any of the South ſignes, or ſubtracted, if hee be in the North ſignes, ſheweth the time of the Sun-riſing. And contrariwiſe, the ſame houres and minutes ſubtracted from ſixe houres when the Sunne is in the South ſignes, or added when he is in the North ſignes, ſheweth the the time of the Sunne-ſetting.

As for example, the Sunne being in the 10. degree of *Taurus* which happeneth about the 20. or 21. day of Aprill) I would know at what houre and minute the Sunne riſeth, and ſetteth at *London* : Hauing therefore found by the former Propoſition the difference of aſcention to be 18. degr. and 5. minutes I take for 15. degrees thereof one houre, and for the three degr. remaining, 12. minutes of an houre, and for the 5. minutes, 20. ſeconds of an houre. Which houre, minutes and ſeconds being ſubtracted out of *6.* houres, becauſe the Sunne is in a North ſigne, there remaineth the time of the Sunnes riſing at 4. a clocke 47. minutes, 40. ſeconds. And adding the ſame houre, min. and ſeconds to 6. houres, you haue the time of the Sun-ſetting that day at 7. a clocke, 12. min. and 20. ſeconds.

PROP. VIII.

To finde the length of the artificiall day or night.

THe artificiall day, is the time conteyned betweene the Sun-riſing and the Sun-ſetting: and the artificiall night is the time betweene Sunne-ſetting and Sun-riſing. The length of both theſe is found after this manner: hauing found the difference of aſcenſion, and reduced it into houres and minutes (as in the former Propoſition) double thoſe houres and minutes, and adde them to 12. houres if the Sunne be in the North ſignes, or ſubtract them from 12. houres if the Sunne be in the South ſignes, for ſo ſhall you haue the length of the day. But (contrariwiſe) ſubtract the ſame houres and minutes (being doubled), from 12. houres, the Sunne being in the North ſignes; and adde them to 12. houres when he is in the South ſignes; ſo haue you the length of the night.

Or elſe, double the time of the Sun-ſetting, ſo haue you the length of the day. And double the time of the Sun-riſing, ſo haue you the length of the night.

As the time of the Sun-riſing being found by the former Propoſition to be 4 houres 48. minutes after mignight at *London*, the Sunne being in the 10. degr. of *Taurus*, by doubling the time of the Sun-riſing, the length of the night ſhall be found to be 9. houres and 36. minutes. And doubling the time of the ſun-ſetting that is 7. houres, and 12. minutes, you haue the length of the day, 14. houres, and 24. minutes.

PROP. IX.

To know the time of the Sun riſing and Sun ſetting.

THe place of the Sunne being found by the 2. Propoſition, bring the ſame to the Meridian, and withall ſet the point of the Index of the houre circle, to the 12. houre in the ſame circle: Then bring the place of the Sunne to the Horizon Eaſtwards; and the point of the houre Index ſhall ſhew you in the houre circle, the time of the Sun-riſing. But if you bring the place of the Sunne to the Horizon Weſtwards, the point of the Index will ſhew in the houre circle the time of the Sun-ſetting.

As for example, the Sunne being in the 10. degree of *Taurus*, bring the ſame degree to the Meridian, and bring the point of the houre Index alſo to the Meridian: then (the Sphere being ſet to the Latitude of *London*) bring the ſame 10. degree of *Taurus* to the Eaſt part of the Horizon, for then the houre Index will ſhew you in the houre circle, that the Sunne riſeth at 4. of the clocke and 48. minutes.

And bringing the ſame degree to the Weſt ſemicircle of the Horizon, the ſame Index will ſhew the time of the Sun-ſetting to be 7. houres and 12. min. after noone.

PROP. X.

To finde the length of the artificiall day or night.

BRing the place of the Sun (being found as before to the Eaſt ſemicircle of the Horizon: ſet the houre Index to 12.a clocke in the Houre circle: turne about the Sphære from the Eaſt Weſtwards, till the place of the ſunne come to the Horizon, and marke how many houres the Index hath runne ouer vpon the Houre circle in the meane time, for ſo much is the length of the day.

And to finde the length of the night: Bring the place of the ſunne to the Weſt ſemicircle of the Horizon, and ſet the Index to 12. a clocke as before; Then turning forwards the Sphære from Eaſt Weſtward till the place of the ſunne come to the Eaſt ſemicircle of the Horizon; ſee how many houres the Index paſſeth ouer in the Houre-circle, for ſo many houres long is the night.

As for example; ſuppoſing the Sunne to be as before in the 10.degree of *Taurus*, bring the ſame degree to the Eaſt part of the Horizon, and the point of the Index to the Meridian: then turning about the Sphære, till the ſame degree come to the Weſt part of the Horizon; you ſhall finde that in the meane time, the point of the Index ſhal paſſe ouer 14.houres and 24.minutes, which is the length of the day. Likewiſe, if you bring the ſame 10.degr. of *Taurus* to the Weſt part of the Horizon, and the Index to the Meridian, and turne about the Sphære, till that degree come to the Eaſt ſemicircle of the Horizon, the number of houres that the Index runneth ouer in the meane time vpon the Houre circle, ſhall be found to bee 9.Degrees, and 36.Minutes.

PROP. XI.

To know the Meridian altitude, or the height of the Sunne at noone, for any time and place.

SEt the Sphære to the latitude of the place where you deſire to know the Sunnes height at noone: bring the place of the Sunne (being ſound as before by the 2. Prop.) to the Meridian, then ſee how many degrees of the Meridian, are contayned betweene the Horizon, and the place of the ſunne, for ſo much is the height of the Sunne at noone.

In like ſort it may be knowne how much the Sunne is vnder the Horizon at midnight, after this manner: Bring the place of the ſunne in the Zodiacke to the Meridian vnder the Horizon, and ſee how many degrees of the Meridian, are contayned betweene the vpper-ſide of the Horizon, and the place of the Sunne downewards: and ſo ſhall you haue that you ſought for.

Or elſe if you cannot well come to the Meridian vnder the Horizon: bring that point of the Eclipticke which is oppoſite to the place of the ſunne, vnto the Meridian aboue the Horizon; for the arch of the Meridian, or the number of degrees and minutes of the Meridian, betweene that point and the Horizon ſheweth how much the ſunne is vnder the Horizon at midnight.

After this manner, the Sunne being in the 10. degr. of *Taurus*, you ſhall find that his Meridian altitude at *London* is 53. degrees, and about one halfe.

As alſo that hee is vnder the Horizon at midnight abont 23. degrees and a halfe at *London*.

PROP.

PROP. XII.

To know how high the Sunne is aboue the Horizon at any time of the day.

BRing the place of the Sun (found by the 2. Prop.) to the Meridian : ſet the houre Index to 12. a clock vpon the houre circle : turne the Sphære about till the Index come to the houre at which you deſire to know the height of the Sunne aboue the Horizon; take the diſtance of the place of the Sunne from the Horizon with a large payre of Compaſſes : then ſet both feet of the Compaſſes in the Eclipticke, and looke how many degrees are conteyned betweene them, for ſo much is the height of the Sunne.

Thus may you finde by the Sphære, that when the Sunne is in the tenth degree of *Taurus*, his height at 10. of the clocke in the fore-noone (the Sphære being duly rectified by the firſt Propoſition) ſhall be about 45. degrees and an halfe at *London*.

PROP. XIII.

To finde the houre of the day by the height of the Sunne; &c.

SEt the pole Artick of the Sphære to his eleuation for that place where you deſire to know the houre of the day : bring the place of the Sunne in the Zodiack to the Meridian, and the houre Index to 12. a clocke of the houre circle : take ſo many degrees of the Eclipticke betweene the feet of your Compaſſes, as the height of the Sunne amounteth vnto.

Then ſet one foot of your Compaſſes in the place of the Sunne, and turne the Sphære about, Eaſtwards, if it be in the fore-noone, or Weſt-wards, if in the after-noone, till you can but onely touch the Horizon with the other foot of your Compaſſes; for then the Index pointeth out the houre of the day in the Houre circle.

As ſuppoſe you obſerue the height of the Sun being in the 10. degr. of *Taurus*, and find him to bee 30. degrees high in the fore-noone: you ſhall find (following the directions preſcribed in this Propoſition) that it ſhall then be about 8. of the clocke in the morning.

Prop. XIIII.

To finde the Amplitude or bredth of the Sunnes riſing, or ſetting,&c.

THe pole of the Sphære being ſet to his eleuation, and the place of the Sunne to the Eaſt ſemicircle of the Horizon: ſee how many degrees of the Horizon, are contayned betweene the place of the Sunne, and the true Eaſt point, for ſo you ſhall haue the bredth of the ſunnes riſing.

Thus the ſunne being in the 10. degree of *Taurus*, you ſhall find by the Sphære, that (for the latitude of *London*) hee riſeth about 23.degr. and a halfe Northwards, from the true Eaſt point, and that hee ſetteth as many degrees towards the North, from the true Weſt point.

Prop. XV.

To finde the place of the Sunne,&c.

THe quarter of the yeare being knowne, bring the quarter of the Eclipticke that is anſwerable thereto, vnder the Meridian; and turne the Sphære to or fro, till there bee ſo many degrees and minutes of the

Meridian, conteyned betweene the Eclipticк and the Equator, as the declination commeth to: then looke what degree of the Eclipticк is vnder the Meridian, for that is the place of the Sunne.

As ſuppoſe the declination of the Sun in ſome day of the Spring-time of the yeare be found to bee 14. degr. 51. min. (turning therefore the Sphære to and fro, till ſome part of the ſpring quarter of the Eclip- tick, come right vnder that degree and minute of declination in the Meridian) you may finde that the Sunne is then in the tenth degree of *Taurus*.

PROP. XVI.

To finde what day of the moneth it is, &c.

THe place of the Sunne being found by his declination (as is already ſhewed) ſeeke the place of the Sunne in the Horizon of the Sphære, and looke what day is anſwerable thereto, for that is the day of the moneth which was ſought for.

As the place of the Sunne being found by his declination (as is ſhewed in the former Propoſition) to be in the 10. degree of *Taurus*, the day of the moneth ſhall thus be found to be the 21. of Aprill.

PROP. XVII.

The day of the moneth being knowne, to finde at what time the day breaketh.

FInde the place of the Sunne (by the 2. Prop.) and bring it to the Meridian, then bring the houre Index, to 12. a clocke vpon the houre circle.

Finde out alſo the point of the Eclipticke that is right ouer againſt the place of the Sunne: then take betweene the feet of your Compaſſes 17. degrees of the Eclipticke, and ſetting one foot of the Compaſſes in the point oppoſite to the place of the Sunne, turne the Sphære Weſtwards, till you can but onely touch the Horizon with the other foot, for then the Index ſheweth in the houre circle at what time the day breaketh.

So the 21. of Aprill, the Sun being in the 10 degr. of *Taurus*, you ſhall finde that the day breaketh about halfe an houre paſt 2. of the clocke in the morning.

PROP. XVIII.

To finde how long the twylight continueth.

Finde out by the former Prop. at what time the day breaketh, and learne alſo at what time the Sunne riſeth by the 7. or 9. Prop.

Then ſubtract the leſſer from the greater, and there ſhall remayne the length of the twylight.

Or elſe thus: hauing brought the point that is oppoſite to the place of the Sunne to be 17. degrees aboue the Horizon Weſt-wards, in ſuch ſort as is ſhewed in the former Propoſition; and keeping the Sphære in that poſition, bring about the point of the houre Index vnto 12. a clocke vpon the houre circle; then turne the Sphære Weſtwards vntill the degree or point of the Eclipticke that is oppoſite to the place of the ſunne come to the Horizon: and ſee how many houres the point of the Index hath runne ouer in the meane time vpon the houre circle: for ſo many houres continueth the twylight.

By eyther of theſe wayes, the Sunne being in the 10. degr. of *Taurus*, you ſhall finde that the twylight (that is the time from the breake of the day till Sunriſe) is about 2. houres and 20. minutes.

Prop. XIX.

To finde how much the declination of the Sunne muſt alter at any time of the yeare, to make the day an houre longer or ſhorter.

BRing the place of the Sunne (found by the ſecond Prop.) to the Eaſt ſemicircle of the Horizon, and marke what degree or point of the Horizon it falleth vpon; bring one of the Colures to the ſame degree or point, and there make a pricke in that colure; and holding the Sphære immoueable,) marke withall what degree of the Equinoctiall, or of eyther of the Tropickes is then at the Horizon: Then turne the Sphære 7. degrees and an halfe forwards, towards the Weſt, if the dayes ſhorten: but contrariwiſe if the dayes lengthen; and holding the ſphære there immoueable, make another prick in the colure at the Horizon: for the diſtance of theſe two prickes in the colure taken with the Compaſſes and brought to the Eclipticke, or Equinoctiall, ſheweth how much the Sunnes declination muſt alter to make the day an houre longer, if the dayes increaſe; or ſhorter, if they decreaſe.

After this manner you ſhall finde that the ſunne being in the 10. degree of *Taurus*, his declination muſt increaſe about 5. degrees, (or little more) to make the day an houre longer; but when the ſunne is in the 20. degree of *Piſces*, his declination, or rather his Meridian altitude, muſt increaſe about 6. degrees to make the day an houre longer: and when ſhee is in the beginning of *Capricorne*, his declination decreaſeth ſcarce 5.degrees to make the day an houre longer.

Prop. XX.

To find how many dayes it is ere the day lengthen or ſhorten an houre.

BRing the foreſaid prickes (made in the Colure by the former Propoſition) vnto the Meridian, and there make two markes iuſtly anſwerable vnto thoſe prickes in the Colure : turne about the Sphære till the Eclipticke line come iuſt vnder one of thoſe markes, and there make a pricke in the Eclipticke : then againe turne the Sphære till the Ecliptick come iuſt vnder the other marke made in the Meridian, and there make another pricke in the Eclipticke : (But here it is to bee noted, that whereas the Eclipticke may be brought vnder that marke whether way ſoeuer you turne the Sphære, it muſt (I ſay be noted that the Sphære muſt be turned that way which may ſooneſt bring the Eclipticke vnder that marke. (Laſtly, finde out amongſt the ſignes and degrees deſcribed vpon the Horizon, the like arch to this, that is contayned betweene theſe prickes in the Eclipticke : For the number of dayes anſwerable to this arch in the Horizon, is the time wherein the day groweth an houre longer or ſhorter.

Thus ſhall you finde, that when the Sunne is in the beginning of *Aries*, it will bee about 18.dayes after, ere the day be one houre longer. But when the Sun is in the beginning of *Capricorne*, you ſhall finde that it will be almoſt twice ſo much, that is neare 34.dayes before the day will be an houre longer.

Hereby therefore the error of them manifeſtly appeareth, which thinke that in euery 15. dayes, the day is lengthened or ſhortened an houre, whereas indeed the lengthning or ſhortning of the dayes, keepeth no ſuch rule. For when the Sunne is about the Equinoctiall points, the dayes lengthen or ſhorten very faſt: but when he is neere the Tropicall points, they grow longer or ſhorter very ſlowly.

PROP. XXI.

To make an Horizontall Diall.

SEt the Sphære to the eleuation of the place for which you would make the Diall: turne about the Sphære, till the ſolſtitiall Colure be 15. degrees (meaſured in the Equinoctiall) from the Meridian; and where the Colure croſſeth the Horizon, there make a prick; then turne the Colure yet 15. degr. further, that is 30. degrees from the Meridian; and where the Colure croſſeth the Horizon, there make an other prick: againe turne the Colure forwards yet 15. deg. more, (that is 45. degrees from the Meridian) and at the common meeting of the Colure and Horizon, make the third prick in the Horizon; and ſo proceed with the reſt, till you haue made ſo many pricks on that ſide of the Horizon as there are houres in halfe the longeſt day. Then looke how many degrees the firſt, ſecond, third, fourth pricks, &c. are from the Meridian, for ſo many degrees muſt the houre lines of 11. a clocke, and one a clocke; of 10. and 2, of 9. and 3. of 8. and 4. &c. be from the 12. a clock line in the Horizontall Dyall.

After this manner in an Horizontall Diall made for the Latitude of *London*, (which is 51.degr. and 32.minutes) you ſhall finde the diſtances of all the reſt of the Houre-lines from the 12. a clocke line as followeth: Betwixt twelue and 11. and twelue and 1. are conteyned 12. degrees almoſt: Betweene 12. and 10. and 12. and 2. there are conteyned 24. degr. and an halfe: Betweene 12. and 9. and 12. and 3. 38. degr. Betweene 12. and 8. and 12. and 4. 53. degr. Betweene 12. and 7. and 12. and 5. 70. degrees and an halfe.

Betweene 12. and 6. both before and after noone, 90. degr. The other houre ſpaces before 6. in the morning, and after 6. in the euening, are equall to the Houre-ſpaces after ſixe in the morning, and before 6. in the afternoone.

PROP. XXII.

How to make a direct mural Diall.

SEt the Pole artick of the Sphære ſo much vnder the Horizon as is the complement of the Poles eleuation: the Horizon therefore being thus ſet as it were to the Zenith of the Sphære, and ſo repreſenting the verticall Circle of Eaſt and Weſt (that is the plaine ſuperficies of a direct mural Diall) you ſhall finde the diſtances of all the houre-lines, (both before and after noone) from the 12. a clock line, in ſuch ſort as you did before for the Horizontall Dial.

So you ſhall finde the diſtances of the houre-lines in an erect direct murall Dial made for the Latitude of *London* to bee as followeth: Betweene the twelue a clock line and the lines of 11. and 1. 9. degr. and about one third part of a degree: Betweene 12. and 10. and 12. and 2. 19. degrees and one quarter;

Betweene 12.and 9.and 12.and 3. 32. degr. or little more: betweene 12.and 8.and 12.and 4. 48.degrees: betweene 12.and 7. and 12.and 5. 67. degr. or little more: betweene 12. and 6. both before and afternoone 90. degrees.

PROP. XXIII.

How to make any direct inclining, or direct reclining Dial.

Reckon from the Equinoctiall vpwards in the Meridian, ſo many degrees as the height of the Pole commeth to at that place where you would make your Diall; for there is the verticall point or Zenith of that place: from this Zenith reckon Southwards in the Meridian, the inclination of ſouth Dials, and the reclination of North Dialls; but contrarywiſe, reckon from the Zenith Northwards the inclination of North Dialls, and the reclination of South Dialls. Then bring that degree of the Meridian, where this reckoning endeth to the Horizon, for ſo the Horizon repreſenteth vnto you the plaine or the flat ſuperficies of the Diall which you would make. Therefore you ſhall finde how many degrees euery one of the houre lines ſhould be diſtant from the 12. a clock line, in ſuch ſort as you did before in making the Horizontall Diall.

Thus in a South direct Diall inclining 30.degr. or in a North direct reclining 30.degrees made for the Latitude or eleuation of the Pole at *London*, you may finde the diſtances of the eleuen a clock line, and of the one a clock line, from the 12. a clock line, to be about 14.degrees.

But the houre lines of 10. in the forenoone, and of

2.in the afternoone, are diſtant from the 12.a clock line 28.degr.& one halfe; From 12.to 9.and to 3.you ſhall find 43.deg. From 12.to 8. in the forenoone, and 4.in the afternoone, you ſhall haue 58.deg.& an halfe: alſo from 12.to 7.& to 5.ſhall be about 74.deg. And from 12.to 6.in the morning, & 6.afternoone 90. degrees.

Likewiſe in a South direct reclining, or North direct inclining 20.deg.for the eleuation of *London*; the ſpaces betweene 12.& 11.& 12.& 1.ſhall be about 5. deg.or little leſſe: Between 12,& 10.& 12,& 2.about 11.deg.& 2.third parts. From 12, to 9. in the forenoone,& 3.in the afternoone, 18.almoſt: From 12.to 8. & 4.29.deg.or little more. From the 12.a clock line, to the line of 7.a clock in the forenoone, & 5.in the afternoone, 50.deg.or thereabouts. From 12.to 6.both before and afternoone, 90.deg.as in the former kindes of Dials. In all which it is to be noted, that there is alwayes the ſame diſtance betweene the houre lines of 5,& 6.& 4,& 6.that there is betweene 7,& 6.and 8,& 6.in the forenoone, and betweene 5,& 6.& 4,& 6.and 7,& 6.& 8,& 6. in the afternoone. So as the diſtances of all the houre lines from the 12. a clock line being found from 6. in the morning, till 6. at night, the diſtances of the other Houre-lines before 6. in the morning, and after 6. at night ſhall eaſily be had.

Prop. XXIIII.

To know at what time the Moone, or any other of the Planets or fixed Stars, that are within the bredth of the Zodiack, riſe, or ſet, or come to the Meridian, &c.

Finde the place of the Moone, or any other of the Planets, both in longitude and Latitude, by the

Ephemerides: and finde the place (that is, the Longitude and Latitude) of any of the fixed Starres in the Zodiack by ſome table of the fixed Starres, or otherwiſe; and marke the ſame place of the Moone, Planet or Starre, in the Zodiack of the Sphære: and hauing ſet the Sphære to the Latitude of the place, bring the place of the Sunne (found by the 2. Propoſition) to the Meridian, and the Houre-index to 12. a clocke vpon the houre-circle; then turne the Sphære till the place of the Moone, Planet or Starre marked in the Zodiack, come to the Eaſt ſemicircle of the Horizon; for then the Index ſheweth the time when the Moone, or that Planet or fixed Starre riſeth. Alſo the number of degrees in the Horizon, contayned betweene the point of the Moones, Planets, or Starres riſing, and the point of true Eaſt, ſheweth the bredth, wideneſſe, or amplitude of riſing. And you may at the ſame inſtant ſee, what degree of the Ecliptick riſeth with any of them, and what the oblique aſcenſion of any of them is: For if you tell how many degrees of the Equinoctiall are contayned betweene the beginning of *Aries* and the Horizon, proceeding Eaſtwards, or according to the order of the ſignes: you ſhall haue the oblique aſcenſion of the Moone, Planet or Starre, that you ſought for.

But bring the ſame place of the Moone, Planet, or Starre to the Meridian, and the Index ſheweth in the houre circle at what time they come to the Meridian: where you may alſo ſee, firſt what degree of the Zodiack middleth Heauen (that is, commeth to the Meridian) with any of them; ſecondly, you may ſee how much the declination of any of them is; for count how many degrees of the Meridian are contayned betweene the Equinoctiall and the place of the Moone, Planet, or fixed Starre, and ſo much is the declination. Thirdly, you may there ſee what the right aſcenſion of any of them is: for the place of any of them being brought to the Meridian and there ſtaied, reckon Eaſtwards how many degrees of the Equinoctiall are contayned betweene the beginning of *Aries* and the Meridian, ſo haue you the right aſcenſion. Laſtly, bring the place of the Moone, Planet or Starre to the VVeſt ſemi-circle of the Horizon; for then the Index ſheweth the time of their ſetting; and the number of the degrees of the Horizon betweene the point, where any of them ſetteth, and the Equinoctiall, or true VVeſt point (where the Equinoctiall, and Horizon croſſe each other) is the amplitude or bredth of the ſetting of any of them, ſhewing how much they ſet from the true VVeſt point.

You may there alſo ſee what degree, either of the Ecliptick, or of the Equinoctiall, ſetteth with any of them: and conſequently you may know the oblique deſcenſion of any of them, by reckoning how many degr. of the Equinoctiall there are from the beginning of *Aries* Eaſtwards, till you come about to the VVeſt part of the Horizon.

Take for example the great Starre called the Bulls eye, whoſe place in longitude is about the 4. degr. of *Taurus*, and his latitude about 5. degrees and an halfe Southwards.

Following therefore the directions preſcribed in this Propoſition, you ſhall finde that vpon the firſt day of Aprill this preſent yeare, 1600. the ſame Starre riſeth here at *London* about halfe an houre paſt 7. of the clock in the morning, and ſetteth about a quarter of an houre paſt 10. at night, and commeth to the Meridian about 3. a clock afternoone: Alſo you ſhall finde that it riſeth with the 15. degree of *Gemini*, and ſetteth with the laſt degr. of *Taurus*, and commeth to the Meridian, or middeth Heauen, with the 5. deg. of *Gemini*: Thirdly, you ſhall finde his declination to be about 15. deg. and 2. third parts, his right aſcenſion 63. degr. and a quarter, his oblique aſcenſion 43. degr. and his oblique deſcenſion about 83. deg. and an halfe: and laſtly his amplitude or bredth of riſing, or ſetting about 25. degr. and an halfe from the true Eaſt and VVeſt points towards the North.

PROP. XXV.

To know how long the Moone, or any of the Planets or fixed Stars doe ſhine or continue aboue the Horizon.

THe Sphære being ſet to the latitude of the place, and the place of the Moone, Planet, or fixed Starre, being found, and marked in the Zodiack, both in Longitude and Latitude, (as in the former Prop.) bring the place of the Moone, Planet, or Star, to the Eaſt ſemi-circle of the Horizon, and the Index of houres to 12. a clock: Then turne about the Sphære VVeſt-wards, till the ſame place of the Moone, or of the ſame Planet, or Starre, come to the VVeſt ſemicircle of the Horizon, and marke withall how many houres the Index runneth ouer in the meane time vpon the houre circle, for ſo many houres continueth the Moone, Planet, or Starre aboue the Horizon.

Thus ſhall you finde that the foreſaid Starre called

The Bulls-eye) commeth, or riſeth aboue the Horizon at *London*, about [illegible] quarters.

PROP. XXVI.

To finde which of the Planets or fixed Starres are aboue or vnder the Horizon at any time, &c.

THe places of the Planets or fixed Starres being marked in the Zodiack of the Sphere, as in the former Propoſitions, and the place of the Sunne brought to the Meridian, and then the Index to 12. a clocke, turne the Sphere till the Index come to that houre vpon the houre circle at which you deſire to know what Planets are aboue or vnder the Horizon, and then hold ſtill the Sphere, and marke what Planets or Starres are aboue, or vnder the Horizon in the Sphære, for the ſame Planets or Starres are aboue or vnder the Horizon in the Heauens.

As for example: the 1. of Aprill *1600*. at *9*. of the clocke at night, you may by this Propoſition finde, that the moſt part of the fixed Starres, that are in the conſtellation of *Taurus*, *Gemini*, *Cancer*, *Leo*, *Virgo*, and *Libra*, together with the three ſuperiour Planets, *Saturn*, *Iupiter* & *Mars*, are at that houre to be ſeene aboue the Horizon, and that the reſt of the Planets and fixed Stars, that are within the compaſſe of the Zodiack, are vnder the Horizon, and cannot then be ſeene.

PROP. XXVII.

To finde in what time any Signe or part of the Ecliptick riſeth or ſetteth.

BRing the beginning of the Signe, or part of the Ecliptick to the Eaſt ſemi-circle of the Horizon, if you would know in how long time it riſeth, or to the VVeſt part of the Horizon, if you would know in what time it ſetteth; then ſet the Index to 12. a clock, and turne forwards the Sphære, till the whole ſigne or part of the Zodiack be riſen, or ſet: For then the Index ſheweth vpon the houre circle in how long time, that ſigne or part of the zodiack riſeth or ſetteth.

Thus you may finde (for example) that the whole ſigne of *Aries* here at *London* riſeth in one houre or ſomewhat leſſe, and ſetteth in two houres and three quarters, or ſomething more: And that the whole quarter of the Zodiack, from the beginning of *Aries* to the beginning of *Cancer*, riſeth in leſſe then foure houres, but ſetteth in more then 8. houres.

PROP. XXVIII.

To finde the houre of the night by any of the Planets or fixed Starres in the Zodiack, &c.

THe place (that is to ſay, the longitude & latitude) of any Planet, or fixed Starre in the Zodiacke, that is aboue the Horizon, being firſt found, and marked in the Zodiack of the Sphære; bring the place of the Sunne (found by the 2. Propoſition) to the Meridian, and the Index to 12. a clocke vpon the houre circle: Then hauing found the height of the Starre, or Planet by obſeruation, and the Sphære alſo being ſet to the Latitude of the place of obſeruation, take betweene the feet of your Compaſſes, ſo many degrees of the Ecliptick, or Equinoctiall, as the height of the Planet, or Starre obſerued, commeth to; and ſetting one foote of your Compaſſes in the place of the Planet, or fixed Starre that you obſerued in the Zodiack,

diack, turne the Sphære forwards or backwards, till you can but onely touch the Horizon with the other foot: for then the Index in the houre circle, ſhall ſhew you the houre of the night.

Suppoſe (for example) I ſhould obſerue the height of the foreſaid Bulles eye, and ſhould finde the ſame to be 29. degrees the firſt day of March at euening; finding therefore the place of that Starre in the Zodiack of the Sphære, and bringing it (with helpe of the Compaſſes) to the height obſerued (hauing firſt ſet the place of the Sunne and houre-Index both together to the Meridian) the Index of the houres will ſhew, that when that Starre hath that height of 29. degrees, it is about 9. of the clock at night.

PROP. XXIX.

To know at any time of the yeare, what Stars in the Zodiack, ariſe or ſet, Coſmically, Achronically, or Heliacally.

SVch Stars as riſe together with the Sunne, are ſaid to riſe coſmically: and ſuch Stars as ſet when the Sunne riſeth, are ſaid to ſet coſmically; But thoſe Stars which ſet together with the Sun, ſet achronycally; and thoſe Stars that riſe when the Sunne ſetteth, are ſaid to riſe achronically. Laſtly, thoſe Starres that riſe a little before the Sunne, riſe heliacally; and thoſe that ſet a little after the Sunne, ſet heliacally.

All which may thus bee found: Bring the place of the ſunne to the Eaſt ſemicircle of the Horizon: for the Stars that are then a little aboue the Horizon riſe heliacally; but thoſe that are in the Horizon in the Eaſt, riſe coſmically; and they that are in the

VVeſt ſemicircle of the Horizon ſet coſmically: But bring the place of the Sunne to the VVeſt ſemicircle of the Horizon, for thoſe Starres as are at the VVeſt part of the Horizon at the ſame time, ſet achronycally; but thoſe that are then in the Eaſt ſemicircle of the Horizon, riſe achronycally: and they which are a little aboue the VVeſt ſemicircle of the Horizon ſet heliacally.

Thus you may know that vpon the 26. or 27. day of May (it our latitude of *London*) the Bulles eye riſeth coſmically, and the Starres in *Serpentarius* his right foot, ſet coſmically, you may ſee alſo that the ſame day the Starre in the Bulls South horne ſetteth achronycally: and the Northermoſt ſtarre in *Serpentarius* his right foot, riſeth achronycally: and laſtly, you may finde that about the ſame time the Pleiades and the Starre in the Bulls North horne, riſe heliacally, and that the ſame Starre alſo, and the former Twinnes feet ſet heliacally.

PROP. XXX.

To finde the foure principall or Cardinall points of Heauen (as the Aſtrologians call them) at any time.

THeſe foure Cardinall points are nothing elſe but foure points of the Eclipticke, whereof one is at the Eaſt part of the Horizon, aſcending, and is therefore called the Aſcendent: another is at the vpper part of the Meridian aboue the Horizon, and is called the midſt of Heauen, and the hart of Heauen: the third is at the VVeſt part of the Horizon deſcending, and may be therfore called the deſcendent: the fourth point is that which is at the nether part of the Meridian

dian vnder the Horizon. Which foure points are the beginnings of the firſt, tenth, ſeuenth, and fourth Houſes. Therefore to finde theſe points at any time by the Sphære, bring the place of the Sunne (being found for that time by the 2. Propoſition) to the Meridian, and the Index to 12. a clocke: then turne the Sphære till the Index come to that houre at which you deſire to know thoſe foure points, and there hold the Sphære that it moue not: and looke withall, what points of the Eclipticke are at the Eaſt and Weſt ſemicircle of the Horizon, and at the vpper and nether parts of the Meridian: for thoſe bee the foure principall or Cardinall points you ſought for.

Take for example the time of the Sunnes entrance into *Aries* this preſent yeare 1600. which was vpon the tenth day of March about eight of the clocke in the morning, or little after with vs here at *London*. Hauing therefore brought the beginning of *Aries* together with the houre Index to the Meridian, and then turned back the whole Sphære till the Index come to 8. of the clocke vpon the houre circle: you ſhall finde the aſcendent at that time, to be the 27. degree of *Taurus*; the middeſt or hart of Heauen, the 27. of *Capricorne*: the deſcendent, the 27. deg. of *Scorpio*; and the loweſt part of Heauen the 27. degree of *Cancer*.

Prop. XXXI.

To finde out the bredth of any climate, &c.

Lift vp, or put downe the pole of the Sphære, till you finde that there are 7. deg. and an halfe of the Tropick of *Cancer*, more or leſſe aboue the Horizon, then there were before; and marke withall how much the pole of the Sphære is raiſed, or let fall in the meane time, more then it was before; for ſo much is the bredth of that climate.

As for example: hauing ſet the Sphære to one Latitude of *London* 51. deg. and an halfe, with the point of your Compaſſes, holding and guiding ſome point of the Tropick of *Cancer* right vnder the Horizon; then lifting vp the Pole till you finde 7. degrees and an halfe more aboue the Horizon then were before, you ſhall finde the Pole eleuated about 2. degr. and an halfe more then it was before.

Likewiſe, if you put downe the Pole till there be 7. degrees and an halfe of the Tropicke of *Cancer*, fewer aboue the Horizon then was before; you ſhall finde the eleuation of the Pole to be about 3. degrees leſſe then before.

PROP. XXXII.

The reaſon of the inequalitie of naturall dayes, &c.

THe reaſon hereof is ſhewed partly by the inequality of the differences of right aſcenſions anſwerable to equall arcks of the Zodiack, and partly by the vnequall apparent motion of the Sunne. For the firſt: the differences of right aſcenſions anſwerable to the parts of the Ecliptick, about the Tropicall points of *Cancer* and *Capricorne*, are much greater then about the Equinoctiall points of *Aries* and *Libra*.

In ſo much that whereas the difference of right aſcenſion anſwerable to one ſigne, or 30. degrees taken about thoſe Tropicall points, is more then 32. degrees and an halfe: about the Equinoctiall points it is little more then 23. degrees and an halfe; as it may appeare by the Sphere. So as you may hereby gather, that the difference of aſcention anſwerable to one degree, which about the beginning of *Capricorne* is one degree, and about 6. minutes; about the beginning of *Aries*, or *Libra*, is onely 55. minutes. Secondly, the apparent motion of the Sun is much ſwifter about his *Perigæum*, in the ſigne of *Capricorne*, then about his *Apogæum* in *Cancer*, or in other parts of the Zodiacke, ſo that whereas the Sunne being in *Capricorne* moueth 61. minutes and ſomething more in a day: in *Aries* or *Libra* he moueth but 59. min. or very little more in the ſame time. Therefore ſeeing the naturall day is nothing elſe, but the time wherein the Sunne moueth from the Meridian about, till it returne again to the ſame part of the Meridian; it muſt needs bee that alwayes in one naturall day, there is made one whole reuolution of the Equinoctiall circle, and ſo much more as is the difference of right aſcention anſwerable to the apparent motion of the Sun in the meane time: which differences of aſcention becauſe they be vnequall, for the two cauſes before alledged; the naturall dayes muſt needs alſo bee vnequall, the motion of the Equinoctiall circle about his owne center being (as it hath beene alwayes ſuppoſed to be) equall, that is mouing alwayes an equall ſpace in equall time.

Which by this example may moſt plainly appeare: The Sunne being in *Capricorne* moueth 61. minutes in a naturall day: the difference of aſcention agreeable thereto is 67. minutes, or ſomething more. Therefore at that time, in the ſpace of one naturall day, the

Equinoctial circle muſt make one full reuolution, and 67. minutes more. But when the Sun is in *Aries*, mouing onely 59. minutes in a day, and the difference of right aſcention anſwerable thereto, ſcarce 54. minutes more then one reuolution of the Equinoctiall circle; there ſhall paſſe onely 54. minutes more in a naturall day; ſo as here the Equinoctiall circle moueth not about ſo much in one day as before by 13. minutes. Seeing then that 15. degr. or little more of the Equinoctiall circle doe paſſe the Meridian in euery houre, and conſequently one degree of the Equinoctiall paſſeth the Meridian in 4. minutes of an houre, and one minute of a degree in 4. ſeconds of an houre; therefore 13. minutes of the Equinoctiall ſhall paſſe the Meridian in 52. ſeconds: that is, almoſt in one minute of an houre: Whereby it manifeſtly appeareth that the naturall day, that is to ſay, the ſpace of 24. houres, which is the time wherein the Sunne moueth from the Noone-ſtead to the ſame noone-ſtead againe, is in our age greater almoſt by one minute of an houre, when the ſunne is in *Capricorne*, then when hee is in *Aries* or *Libra*.

PROP. XXXIII.

To finde by the Sphære how much the naturall dayes are longer at one time of the yeare then at another.

FOr this purpoſe it will be beſt to take a good number of dayes together; as for example, take the whole moneth of December, and the whole moneth of March: both which moneths conſiſt of the ſame number of 31. naturall dayes: find the place of the Sunne for the beginning, and ending of both moneths, which you may finde by the ſecond Propoſition to be for the beginning of March this preſent yeare 1600. about 20. degrees and 15. minutes of *Piſces*; and for the ending about 20. degr. 48. minutes of *Aries*: Alſo for the beginning of December the ſame yeare 18. degr. 40. minutes of *Sagittarie*; and for the ending, 25. degrees 24. minutes of *Capricorne*: Then ſeeke out the right aſcenſions of the ſame places of the Sunne for the beginnings and endings of both thoſe moneths by the fourth Propoſition, and the differences of aſcenſion anſwerable to the motion of the Sunne in each moneth, by the ſixt Propoſition; which you may finde by the Sphære to be about 33. degrees, 24. minutes for December, and 28. degrees, 39. minutes for March. Laſtly, finde out the difference of theſe differences of aſcenſion by ſubſtracting the leſſer out of the greater; which in this example is 4. degrees 45. minutes; which reſolued into minutes of an houre, by taking for euery degree 4. minutes of an houre, and for euery 15. minutes of a degree, one minute of an houre ſhall amount to 19. minutes of an houre, that is a quarter of an houre and 4. minutes. And ſo much is the moneth of December longer then the moneth of March; Notwithſtanding both of them conſiſt of the ſame number of 31. naturall dayes.

The third Part.

Of the Orbes whereof the SPHÆRES of the Sunne and Moone haue beene imagined to bee made, and of their Motions and Vſes.

CHAP. I.

Of the Orbes whereof the Sphære of the Sunne is made.

Within the Sphære or Orbe contayning all the Circles that wee haue hitherto ſpoken of, and repreſenting vnto vs the *Primum mobile*; that is, the firſt and higheſt moueable Heauen, that hath been imagined by the Aſtronomers, to ſhew the reaſon of that daily motion, which appeareth to bee in all the Heauens, and of all the apparences that follow thereupon, are included the Sphæres and Orbes of the Sunne and Moone.

The ſphære of the Sunne contayneth three Orbes: The vppermoſt of them (which in this Sphære is ſignified by the yellow Circle that commeth next within the compaſſe of the Zodiacke) is called *Deferens apogæum Solis*; that is, the Orbe which carrieth about that point, wherein the ſunne is furtheſt diſtant from the earth.

Next within this Orbe is placed the Eccentrick carying about the body of the Sunne; which in this Sphære is repreſented by the greene coloured circle that commeth next vnder the *Deferens apogæum.*

Againe, within this Eccentrick is included the third Orbe of the Sphære of the Sunne called *Deferens Perigæum ſolis*, that is, the Orbe carying about that point wherein the Sun is neareſt to the Earth. This is the nethermoſt of the three Orbes of the ſunne, and in this Sphære is repreſented vnto you by the yellow coloured circle next vnder the ſunnes Eccentricke.

CHAP. II.

Of the vppermoſt and nethermoſt Orbes of the Sphære of the Sunne, more particularly.

IN the vppermoſt and nethermoſt of theſe three Orbes, there be 4. points eſpecially to bee conſidered: That is, the points where they bee narroweſt and where they be broadeſt, and where they are of a meane bredth betwixt the narroweſt and broadeſt. For at the narroweſt part of the vppermoſt Orbe, where you may ſee written *Aux ſolis*, and the broadeſt part of the nethermoſt Orbe, is the place of the ſunnes *Apogæum*; ſo that whenſoeuer the Sun commeth there, he is furtheſt diſtant from the earth. As you may eaſily try, if (with a payre of Compaſſes, or otherwiſe) you take the diſtance betwixt the Earth and the Sunne, being brought about to that place, and compare the ſame with the diſtances that the Sun hath from the Earth in other places. This point is called *Aux Solis*, and *Longitudo longior*, that is, the point of the ſunnes furtheſt diſtance from the earth. But vnder the broadeſt part of the vppermoſt and vttermoſt Orbe, where you ſee printed *PERIGÆVM*, and right aboue the narroweſt part of the nethermoſt Orbe, is the place where the Sun commeth neareſt to the Earth, as you may eaſily find (with your Compaſſes, or otherwiſe) in like ſort as before was ſhewed. The point where the Sun commeth neareſt to the earth, is called *oppoſitum Augis*, and *longitudo propior*, that is, the point oppoſite to the *Apogæum*, and the neareſt diſtance. And at thoſe parts of this Orbe, which are in the midſt betweene the former; the Sunne hath a meane diſtance from the earth: a meane (I ſay) betweene the leaſt, and greateſt diſtance. The very point wherein this meane or middle diſtance hapneth, is ſhewed by the points that are iuſt in the middeſt betweene the ſhort lines A B, and I K, which are drawne ouerthwart on eyther ſide of this Orbe. Theſe points are called *longitudines media*; that is, the meane diſtances of the Sunne, becauſe the ſunne comming to theſe points, hath a meane diſtance betweene the leaſt and the greateſt. About theſe points alſo, the true motion of the ſun, is as it were in a meane between the ſloweſt, which hapneth the ſunne being about the *Apogæum*, and the ſwifteſt, which hapneth about his *Perigæum*.

Moreouer the lines A, and K, ſhew the places wherin there is the greateſt *Proſthapharisis*, or Equation of the ſunne: that is, the greateſt difference betweene the true, and middle, or meane place of the ſunne.

Laſtly, the diſtance betweene the lines I, and K, or A, and B, ſhew how much the eccentricitie of the ſunnes eccentricke is, that is, how farre the Center of the eccentricke is diſtant from the Center of Earth.

Chap. III.

CHAP. III.

To finde how much the Sunne is nearer or further from the earth, at one time then at another.

BY meanes of this Circle, you may eaſily find with your Compaſſes, how much the Sunne is nearer to, or further from the earth at one time, then at another: for hauing ſet one foot of the Compaſſes vpon the vtmoſt edge of the *Deferens Apogæum*, vnder the place of the Sunne in the Zodiacke, found by the ſecond Prop. ſtretch out the other foot, to the innermoſt edge of the ſame Orbe; for then, if you ſet one foot of your Compaſſes, vpon the vtmoſt edge of this Orbe, at the *Apogæum*, the other foot turned inwards towards the center of the Sphære, will ſhew you how much the Sunne is nearer to the Earth at that time, then when he is in his *Apogæum*: for ſo much as that foot reacheth within the inner edge of the Orbe, ſo much is the ſunne nearer. Likewiſe if you ſet one foot of your Compaſſes, vpon the vttermoſt edge of this Orbe, at the *Perigæum*, and turne the other foot towards the center of the Sphære, ſo much as this foot of the Compaſſe, is from the inner edge of the *Deferens Perigæum*, ſo much is the Sun further diſtant from the earth at that time, then when he is in his *Perigæum*.

CHAP. IIII.

Of the ſituation and motion of the vppermoſt, and nethermoſt Orbes of the Sunne.

THe vppermoſt, and nethermoſt of theſe three Orbes, called *Deferens Apogæum*, & *Perigæum ſolis*, doe alwayes anſwer each to other, in ſuch ſort that the broadeſt part of the one, is alwayes againſt the narroweſt part of the other: And therefore both of them are moued thgether, with one motion about the Axtree and poles of the Ecliptick, making one reuolution vnder the Zodiack, in the ſpace of 17000. yeares almoſt. For in *Ptolemee* his time (that is about the yeare of our Lord 134.) the place of the Sunnes *Apogæum*, was about the middeſt of the 6. deg. of *Gemini*; as it may appeare by the 4. Chapter of the 3. booke of his Almageſt. But in our time we finde that it cannot exceed the 7. degr. of *Cancer*, although after the account of *Copernicus*, and of the Prutenicke tables, it ſhould be in the 9. degr. of *Cancer*. So as, if the reſt of the motion of the Sunnes *Apogæum*, that is to come hereafter, be proportionable to that is paſt, the whole reuolution thereof ſhalbe finiſhed in 1699. yeares vnder the Zodiack. For in 1463. yeares betwixt *Ptolemee* his time and ours, it hath moued about 31. degr. therefore it ſhall moue 360. degrees, (that is, the compaſſe of the whole circle) in 16990. yeares.

VVhich number of yeares being deuided by 360. it ſhall appeare that the *Apogæum* of the Sunne moueth one degr. in little more then 47. yeares whereby the yearely motion thereof may be found to be little more then one minute and a quarter.

CHAP. V.

How to find the place of the Suns Aux *or* Apogæum, *&c.*

THerefore the place of the Sunnes *Apogæum*, being found for the yeare 1600. to be about 7. degr. in *Cancer*, the place thereof for any other yeare before or after, may eaſely be found in our age, onely by ſubtracting, or adding for euery 4. yeares 5.min. and for euery ſingle yeare 1.minute and a quarter. Although indeed we need not ſtand ſo preciſely neyther vpon quarters of minutes, neither yet vpon whole minutes, in the place of the ſunnes *Apogæum*, which cannot be by any Art ſo exactly found, but that the diligenteſt man that is, may erre many minutes therein.

Take for example the yeare of our Lord 1558. (in which our gracious Q. *Eliſabeth* began her happie reigne, which is now 42. yeares ſince) taking therefore for euery 4. yeares 5. minutes, that is, for 40. yeares 50. minutes, and for the two yeares remaining 2. minutes and one halfe; that is in all 52. minutes and an halfe, and ſubtracting the ſame out of 7. deg. of *Cancer*, there ſhall remaine the place of the ſunnes *Apogæum* at the beginning of her Maieſties reigne, in 6. degr. and about 8. min. of *Cancer*.

The vſes of theſe two Orbes are theſe.

1. Firſt to make the ſphære of the Sunne concentricall; for theſe Orbes be framed together, that the narroweſt part of the one, anſwereth alwayes to the broadeſt part of the other: it commeth to paſſe by this meanes, that both the out-ſide, and the in-ſide of the Sphære of the ſunne, haue alwayes the ſame center, that the world it ſelfe hath.

2. The ſecond vſe is to ſhew the reaſon, and manner of the motion of the Sunnes *Apogæum* and *Perigæum*.

CHAP. VI.

Of the eccentrick of the Sunne, &c.

THe Orbe conteined betweene the two former, and carying about the body of the Sunne it ſelfe, is called the eccentricke of the Sunne; becauſe it hath another center, then the center of the world. The eſpeciall reaſon, that moued the skilfull in this cœleſtiall ſcience, to make this Orbe (wherein the body of the ſunne is carryed) eccentricall, was becauſe they found the apparent motion of the ſunne vnder the ecliptick line to be vnequall, that is, ſwifter in the Southerly Signes: and ſlower in the Northerly.

For *Hipparchus*, and *Ptolemee* found in their times, that the ſunne continued in the Northerne ſemicircle of the ecliptick, from *Aries* to *Libra*, 187. dayes: and in the other halfe of the Zodiack, that is Southward from *Libra* to *Aries*, 178. dayes and a quarter onely. But in our time by diligent obſeruation it is found, that the time of the ſunnes continuance in the firſt of thoſe ſemicircles from *Aries* to *Libra*, is 186. dayes 14. houres and an halfe: and conſequently in the other ſemicircle, from *Libra* to *Aries*, 178. dayes 15. houres and an halfe. Taking it therefore for a ground, according to the doctrine of *Ariſtotle*, that the motion of the cœleſtiall bodies is circular and equal; it muſt needs follow, that a greater part of the circle deſcribed by the proper motion of the ſunne muſt be conteined vnder the Northerly ſemicircle of the ecliptick, then vnder the Southerly: and conſequently that the circle or Orbe that caryeth about the body of the Sunne vnder the ecliptick, hath another center then the center of the Ecliptick.

2. Another reaſon to proue, that the Sunne is caryed in an eccentricall Circle, is the vnequall apparent, bignes of the Sunnes diameter, the Sunne being of the ſame height aboue the Horizon and the

ayre alike affected, and alike cleare; ſo as if there were any refraction by reaſon of the thicknes of the ayre, it muſt needs be the ſame in both places. For in Sommer, when the Sun is at, or neare his *Apogæum*, his apparent diameter hath beene found by exquiſit obſeruation to be 13. minutes 48 ſeconds. But in winter being about his *Perigæum* 33. min. 54. ſeconds, as it may appeare in *Copernicus* his reuolutions 4. booke 21. Chapter.

Therefore ſeeing euery viſible obiect appeareth greater when it is neare, and leſſe when it is further remoued from vs, it is manifeſt that the Sun appearing greater in winter, then in ſommer, muſt needes be nearer to the earth in winter, then in ſommer.

The reaſon of which apparance is moſt eaſely ſhewed, by ſuppoſing the Sunne to be moued, in an eccentricall Orbe.

3. A third reaſon may bee the vnequall greatneſſe and continuance of the eclipſes of the Moone, euen at thoſe times when ſhe hath had the ſame latitude, or diſtance from the Ecliptick, and the ſame diſtance from the Center of the earth: which argueth that the conicall ſharp pointed ſhadow of the earth, in the place where the Moone in time of the Eclipſe paſſeth through that ſhadow, at the ſame diſtance from the earth, is ſometimes greater, and ſometimes leſſer: wherof there can no cauſe be ſhewed more reaſonable then this, that the Sun is ſometimes further diſtant from the earth, and then maketh the ſhadow greater and ſometimes nearer, and ſo maketh it leſſer. Whereby it is alſo manifeſtly proued, that the Sun is moued about another center then the center of the

earth, and therefore that the circle or Orbe, wherein the Sunne is moued, is an Eccentricke.

CHAP. VII.

Of the vſes of the Sunnes eccentricall Orbe.

THerefore the vſes of the Sunnes eccentricke may bee theſe:

1. Firſt to ſhew the reaſon of that apparent inequalitie, which ſeemeth to bee in the motion of the Sunne: for although the Sunne mode equally in his owne Orbe, and about his owne center, yet to them that are at the center of the world, or vpon the earth, he ſhall ſeeme to moue vnequally; that is, ſwiftly when he is in that part of his eccentricke which is neareſt vnto the earth, and ſlowly when he is fartheſt from the earth. And therefore in ſommer, when the Sunne is about his *Apogæum*, and in his greateſt diſtance from the earth, he ſeemeth to moue little about 57. min. in one day. But in winter, being about his *Perigæum* and neareſt vnto the earth, he ſeemeth to moue more then 16. minutes: whereas notwithſtanding he moueth equally in his Eccentricke, euery day about nine and fifty minutes and 8. ſeconds; and ſo finiſheth his reuolution in 365. dayes, and ſix houres almoſt.

2. The ſecond vſe of the Sunnes Eccentricke, may be to ſhew the reaſon why the Sun appeareth greater at one time then at another; for the Sun being in thoſe parts of the eccentrick that are neareſt vnto vs, ſeemeth greateſt, and when he is in thoſe parts of his eccentrick that are furtheſt from vs, he appeareth to be leaſt.

3. And laſtly the inequality of the Sunnes diſtance

from the earth, cauſed by his eccentrick, is one eſpeciall cauſe of the inequalitie of the Eclipſes, both of the Sunne and Moone.

Chap. VIII.

The definitions of certaine Aſtronomicall wordes of art, for the better vnderſtanding of the Theorick of the Sunne.

1. What the *Aux* or *Apogæum* of the Sunne is, it hath beene partly ſhewed already: that namely it is that part, or rather point of the Orbe carying the Sunnes *Apogæum*, wherein the ſaid Orbe is thinneſt, or narroweſt: Or it is that point of the eccentrick which is furtheſt diſtant from the earth, and is alwayes ſhewed by a right line vnderſtood to be drawn from the center of the world, by the center of the eccentrick, vnto the Orbe carying the Sunnes *Apogæum*. Which line is therefore called the line of the Sun his *Aux* or the line of the Sunnes *Apogæum*.

apogeum
fo: Sox. dos.
from ẏ earth

2. The motion of the *Aux*, or of the *Apogæum* of the Sunne (which is alſo called the Sunnes *Aux* in the ſecond ſignification) is nothing els but the arch of the Ecliptick, conteyned betweene the beginning of Aries, and the line of the Sunnes *Apogæum*, drawne forth to the Zodiack, where this line alſo ſheweth the place of the Sunnes *Apogæum*.

3. The middle or meane place of the Sunne in the Zodiack, is ſhewed by a line drawne from the center of the world vnto the Zodiack, equidiſtant from the center of the Eccentricke, and of the Sunne.

4. This line is therefore called the line of the meane or middle place of the Sun.

5. The middle or meane motion of the Sunne is the arch of the ecliptick betweene the beginning of Aries, and the middle place of the Sun.

6. The true place of the Sunne is ſhewed by a ſtreight line drawne from the center of the earth by the center of the Sun vnto the Zodiack, which line is therefore called the line of the true place of the Sun.

7. The true motion of the Sun is the arch of the ecliptick from the beginning of Aries, vnto the true place of the Sun.

8. The argument of the Sun (as the *Alphonſines* terme it) or the motion of the Sunnes Anomalie (as *Copernicus* calleth it) is the arch of the ecliptick conteyned betweene the place of the Sunnes *apogæum* and the middle place of the Sunne according to the order and ſucceſſion of the Signes. This arch is called the argument, or motion of the ſunnes Anomalie, or irregularitie, becauſe that by it is alwayes found how much the ſuns true motion which (is vnequall and irregular) differeth from his middle motion, which difference they call the Suns equation, or proſthaphereſis.

9. The equation, or proſthaphæreſis of the Sun is nothing els but the arch of the ecliptick conteyned betweene the true, and middle places of the ſunne.

This arch is called the ſunnes equation, becauſe it maketh the ſuns middle motion equal to his true motion, being added to it or ſubtracted from it, as occaſion requireth: for which cauſe it is more ſignificantly and fitly called *Proſthaphæreſis*, that is as much to ſay, as that which is to be added to or ſubtracted from the middle motion, that ſo we might haue the true motion. For ſo long as the Sunne is in the ſemicircle of his eccentricke, diſcending from his *Apogæum* to his *Perigæum*, ſo long this *Proſthapheræſis* is to be ſubtracted from the middle motion: but the Sunne being in the other halfe of his eccentricke aſcending, the *Proſthapheræſis* or equation of the Sun muſt be added to the middle motion, that ſo the true motion and place of the Sunne may be found. Becauſe that in the firſt ſemicircle of the eccentricke deſcending, the middle place of the Sunne goeth before the true place, and the middle motion is alwayes greater then the true motion of the Sun, and therefore the difference of theſe two motions, (that is to ſay, the equation or *Proſthapheræſis*) muſt be ſubtracted, to finde the true motion. But in the other halfe aſcending, it falleth out contrary, for the true place of the Sunne goeth alwayes before the middle place, and ſo the true motion is greater then the middle motion, and therefore this equation muſt be added to the middle motion for the finding out of the true motion and place of the ſame.

Of the vppermoſt Orbe of the Sphære of the Moone caryng the Dragons head and tayle.

NExt within the Orbes of the Sun in this Sphære are conueyed the Orbes of the Sphære of the Moone, which are fiue in number.

The vppermoſt of them (which in this Sphære is next vnder the Orbe that caryeth the Suns *Perigæum* and is coloured with red) is called the Caryer of the Dragons head and tayle, or *Deferens nodos*, which is as much to ſay as the Caryer of the knots, that is of the two interſections, or pointes wherein the reſt of the Orbes of the Moone, doe croſſe ouer-thwart this Orbe. This Orbe is deuided into foure nineties of degrees, for the eaſieſt reckoning of the motion and place of the Dragons head or tayle in this Sphære. And it is moued about in 18. Julian yeares 224. dayes 3. houres and 5. minutes almoſt, from the Eaſt Weſtwards, vnder the ecliptick. By reaſon of this motion it commeth to paſſe, that the Eclipſes, or rather the places wherein the eclipſes of the Sunne or Moone doe happen in the Heauens, are remoued continually more backwards in the Zodiack, contrary to the order and ſucceſſion of the Signes.

As for example; the eclipſe of the Moone happning this preſent yeare 1600. the 20. of Ianuarie neare vnto the Dragons tayle about the 9. degree and 40. min. of *Leo*; the next eclipſe that ſhall happen neare the ſame interſection of the Dragons taile, in the yeare 1601. the 29. of Nouember, ſhall be in 17. degrees and an halfe of *Gemini*: And that eclipſe which ſhall be the next yeare after neare the ſame interſection the 19. of Nouember in the morning, ſhall be about the 6. degree and 40. minutes of Gemini, &c.

All this remouing of the Eclipſes backwards commeth to paſſe, by reaſon of the motion of this Orbe carying the Dragons head and tayle, contrary to the courſe and order of the Signes.

This Orbe continueth alwaies right vnder, and euen with the Orbes of the Sphære of the Sunne which abide alwaies in all parts iuſt vnder the ecliptick line, and hath his center agreeing, and all one

The ſcituation of the Orbe carying the Dragons head and tayle.

with the center of the world, and of the ecliptick: And therefore the poles and axtree, about which this Orbe is turned, agree iuſtly with the axtree of the Ecliptick.

The ſcituation of the reſt of the Orbes.

The reſt of the Orbes of the Moone, that are conteyned within this, haue all theire playnes agreeing in one, and lying euen one with another. But the one halfe of all their playnes, ariſeth aboue the playne of the former Orbe, and of the Ecliptick, towards the North pole of the Zodiack; and the other halfe deſcendeth beneath the playne of the ecliptick, toward the South pole: euen as the one halfe of the Zodiack ariſeth aboue the Equinoctiall circle towards the North: and the other halfe deſcendeth towards the South. And as the angle of interſection, or obliquitie of the ecliptick with the Equinoctiall circle, is 23. degr. and an halfe or little more: ſo the angle of interſection, or obliquity of the playnes of theſe Orbes of the Moone, from the plaine of the Ecliptick, and of the former Orbe carying the Dragons head and taile, is 5. degrees, or (according to *Tigho Brahe* his obſeruation) 5. degr. and a quarter almoſt ſometimes, and ſometimes leſſe then 5. degr.

That point or interſection of theſe Orbes with the former, from which they begin to ariſe about the playne of the ecliptick towards the North, proceeding Eaſt-wards, is called the Dragons head; and is ſignified by this character ☊: and the other point or interſection diametrally oppoſite vnto this, is called the Dragons tayle, which is alſo ſignified by the former character turned vp ſide downe after this manner, ☋.

The two points of theſe Orbes that are furtheſt diſtant from the plaine of the ecliptick, are called the bounds or limites of the Moones latitude; and they are 90. deg. from the Dragons head and tayle, and 5. deg. and a quarter almoſt from the playne of the Ecliptick, according to the obliquity, or greateſt declination of the playnes of theſe Orbes, from the playne of the ecliptick: Of theſe two points, that which is in the north ſide of the ecliptick, is called the North limit, or bound of the Moones latitude; and contrariwiſe, the other point oppoſit to this on the ſouth ſide of the Ecliptick, is called the South limite of the Moones latitude. And when the Moone commeth to eyther of theſe two points, ſhe hath her greateſt latitude.

CHAP. X.

Of the Orbes carying the Moones Apogæum *and* Perigæum.

NExt within the Orbe carying the Dragons head and tayle, is contayned the Orbe called *Deferens Apogæum lunæ* which is the point wherein the Moone is furtheſt diſtant from the earth.

And vnder this Orbe is placed the Moones Eccentrick, which is alſo called *Deferens Epicyclum Lunæ*, that is the Orbe carying the Moones Epicycle.

Againe within this eccentrick of the Moone, is conteyned the leaſt and loweſt Orbe, of all that are in this Sphære, VVhich they call *Deferens Perigæum Lunæ*; that is, the Orbe carying the Moones *Perigæum*, which is the point wherein the Moone commeth neareſt to the earth.

The vppermoſt and nethermoſt of thoſe three

Orbes, that is to ſay, the Orbes carying the Moones *Apogæum* aud *Perigæum* (both which Orbes in this Sphære are coloured with blew) are alwaies placed in ſuch ſort, that the narroweſt part of the one, is continually anſwerable to the broadeſt part of the other, whereby it commeth to paſſe, that the Sphære of the Moone is made concentricall, that is to ſay, to haue the ſame center with the world: which alſo is one eſpeciall vſe, why theſe Orbes were deuided.

Another vſe of theſe Orbes, is to ſhew the reaſon of the motion of the Moones *Apogæum* and *Perigæum*: Therefore both theſe Orbes are moued togither with one motion equally, about the center of the world, in the ſame time from the Eaſt Weſtwards, in the ſpace of 32. dayes 3. houres and 5. minutes almoſt: So mouing in one day 11. deg. 12. min. and 1. third part almoſt. The axtree, about which theſe Orbes are moued equally, paſſeth through the center of the world and of the ecliptick: but the poles of theſe Orbes differ from the poles of the Ecliptick and of the Orbe carying the Dragons head and tayle, by the ſpace of 5. degr. and a quarter, or thereabouts, which poles are caryed about the poles of the Orbe carying the Dragons head and tayle, with the motion of the ſame Orbe, in the ſpace of 19. yeares almoſt. Whereby it commeth to paſſe, that the poles of the Orbe carying the *Apogæum* and *Perigæum* of the Moone, deſcribe certaine litle circles about the poles of the Orbe that carieth the Dragons head and taile, euen as the Arctick, and Antarctick circle in the ordinary Sphære, are deſcribed by the motion of the poles of the Ecliptick, caryed about dayly with the motion of the firſt and higheſt moueable Sphære, in the ſpace of 24. houres almoſt.

CHAP. XI.

Of the eccentricke of the Moone.

THe Eccentrick of the Moone contained betweene the two former Orbes and coloured with a ſad yealow colour in this Sphære, is moued equally about the center of the ſame Orbes, from the Weſt towards the Eaſt, finiſhing his motion vnder the Zodiack, in the ſpace of 27. dayes, and 8. houres almoſt: and with this motion, it caryeth about the Moones Epicycle equally, vnder the Zodiack.

Therefore the motion of this Orbe, about his owne center, muſt needs be vnequall, that is to ſay, ſwifter in thoſe parts that are about the *Apogæum*, and ſlower in the lower parts about the *Perigæum*: Becauſe that greater arches of the Eccentrick, doe anſwer to equall arches of the Zodiack about the *Apogæum*, then about the *Perigæum* of the Eccentrick.

The axtree about which this Orbe is moued, is alwaies in all places equidiſtant from the axtree of the Orbe carying the *Apogæum* of the Moone: and the poles of the axtree of the Moones eccentrick, are faſtned in the Orbe carying the Moones *Apogæum*, equidiſtantly from the poles of the ſame Orbe: therefore theſe poles together with the whole axtree of the eccentrick, are caryed and equally moued about the poles and axtree of the Orbe carying the *Apogæum* from the Eaſt, towards the Weſt. With this motion therefore, the poles and center of the eccentrick, deſcribe certaine litle circles of equall bignes, about the poles, and center of the Orbe carying the *Apogæum* from the Eaſt Weſt-wards. And therefore alſo the *Apogæum* of the eccentrick, is moued about equally, vnder the ecliptick, contrary to the order of Signes from the Eaſt Weſt-wards. Whereby it commeth to paſſe, that both the *Apogæum* and center of the eccentricke, are ſomtimes vnder the Ecliptick, that is, when they are vnder the Dragons head or taile: but for the moſt part they are beſide the plaine of the ecliptick, either towards the North, or elſe towards the South.

Hereby alſo it appeareth, that the plaine of the Ecliptick doth not alwayes deuide the plaine of the eccentricke into epqall parts or halfes; but then onely, when the Center and *Apogæum* of the Eccentrick, is right vnder the Dragons head or tayle; for then onely the plaine of the Ecliptick deuideth the plaine of the Eccentrick, by the center therof; and conſequently deuideth it preciſely into two halfes. Otherwiſe, if the *Apogæum* of the eccentrick, be not vnder the Dragons head or tayle, looke on which ſide of the plaine of the ecliptick the *Apogæum* is, for on the ſame ſide of the ecliptick is the greater part of the eccentrick.

CHAP. XII.

In what proportion the Moones eccentrick, and Orbe, carying her Apogæum *are moued.*

NOw the Eccentrick of the Moone, and the Orbe carying her *Apogæum*, are moued in ſuch ſort, that the middle place of the Sunne, is alwayes right in the midſt betweene the center of the Epicycle caried in the eccentrick, and the *Apogæum* of the Eccentrick; except it be when the center of the epicycle is in coniunction, or oppoſition to the middle place of of the Sunne. For in euery middle coniunction and oppoſition of the Sunne and Moone, the center of the Epicycle, and the *Apogæum* of the eccentrick are vnited together; But in the coniunction they are both conioyned with the middle place of the Sun; and in the oppoſition they are both together oppoſite to the ſame. Whereof it followeth, that in the firſt and laſt quarters of the Moone, the center of her epicycle is diametrally oppoſite to the *Apogæum* of her eccentrick.

Hereof it commeth to paſſe, that although the Moone haue the ſame poſition in her epicycle at the time of the new and full Moone, and of the firſt and laſt quarters; yet the equation, or proſthaphæreſis of the Moones Argument (as they call it) that is the difference betweene the true, and middle places of the Moone, is alwayes greater in the firſt and laſt quarter, then in the full and new Moone. Hereby likewiſe it appeareth that in the time contayned betweene new Moone and new Moone (which they call *Menſem ſynodicum*, that is the moneth coniunctionall, or the time from coniunction to coniunction) the center of the epicycle maketh two complete reuolutions, vnder the Orbe carying the *Apogæum* of the Moones eccentrick.

And therefore in euery moneth, the center of the epicycle commeth twiſe to the *Apogæum* and twiſe to the *Perigæum* of the eccentrick; and ſo the monthly motion of the center of the epicycle, deſcribeth an oual figure: the ends whereof are alwayes towards the place of the full and new Moone, and the ſides towards the places of the firſt and laſt quarter.

By this that hath beene ſpoken, it is alſo manifeſt, that if the middle motion of the Sunne, be ſubtracted out of the middle motion of the Moone, there remaineth the middle motion of the Moones longitude from the ſunne, and that if this longitude againe be doubled, you ſhall haue the motion of the center of the Moones Epicycle from the *Apogæum* of her eccentrick, which motion they call the center of the Moone.

CHAP. XIII.

Of the Epicycle of the Moone, and how it is moued.

THe little Orbe placed in the Eccentrick, is called the Epicycle of the Moone; in the circumference whereof is alſo placed the body of the Moone, repreſented by the round Beade, ſet into the Moones Epicycle in this Sphære.

The plaine ſuperficies of this epicycle agreeth euen with the plaine of the eccentrick: and the axtree about which it is moued, is perpendicular to the plaine of the eccentrick. This Epicycle is moued equally from his middle *Apogæum*, about his owne center and axtree from the Eaſt Weſtwards, contrary to the motion of the eccentrick, carying forwards the body of the Moone with this motion 13. degrees and almoſt 4. min. euery day, and finiſhing his reuolution in 27. dayes 13. houres and 19. minutes almoſt.

The middle *Apogæum* of the Epicycle is ſhewed by a right line, imagined to be drawne, from that point of the little circle (deſcribed by the motion of the center of the Moones eccentrick) which is oppoſite to the center of the Eccentrick, by the center of the Epicycle vnto the vpper part of the Epicycle.

But the true *apogæum* of the Epicycle, is ſhewed by a right line, vnderſtood to be drawne from the Center of the earth by the center of the Epicycle, vnto the vpper part of the circumference thereof.

By the motion of this Epicycle it may eaſily be conceiued why the Moone ſeemeth to moue ſometimes ſwifter and ſomteimes ſlower: For ſeeing that the vpper part of the Epicycle, moueth contrary to the motion of the Eccentrick from the Eaſt Weſtwards, when the Moone commeth in that part, ſhee muſt needs ſeeme to moue more ſlowly, to them that are at the center of the world.

Why the Moone ſeemeth ſometimes to moue ſwifter, ſometimes ſlower.

But when the Moone commeth in the nether part of the Epicycle, the Eccentrick caryeth the Epicycle and the Epicycle caryeth the body of the Moone both one way: that is, from the Weſt Eaſt-wards, and therefore at this time the Moone ſeemeth to moue more ſwiftly. According as you may ſee in Ephemerides, the diurne motion of the Moone to be ſometimes little more then 11. degrees and ſometimes againe little leſſe then 15½. degrees. The true motion of the Moone ſeemeth then to be ſwifter, when the Moone is in the *Perigæum* of her Epicycle, and the Epicycle in the *Perigæum* of the Eccentrick; becauſe then ſhe is not onely caryed forwards the ſame way both by her Epicycle and Eccentrick, but ſhe is alſo at that time neareſt vnto vs; for which cauſe her motion ſhall ſeeme ſwifter, then when the Epicycle is in other parts of the Eccentrick.

CHAP. XIIII.

The definitions of certaine Aſtronomicall wordes of Art, for the better underſtanding of the Theoricke of the Moone.

1. THe line of the Moones middle motion, is a line vnderſtood to be drawne from the center of the earth, by the center of the Moones Epicycle, vnto the Zodiack.

2. This line ſheweth the middle place of the Moon in the Zodiack.

3. And the middle motion of the Moone, is the arch of the Zodiack, from the beginning of Aries, vnto the ſame line.

4. So likewiſe the line of the true motion, or of the true place of the Moone, is drawne from the center of the world, by the center of the Moone, to the Zodiack.

5. This line therefore ſheweth the true place of the Moone in the Zodiack.

6. And the true motion of the Moone, is the arch of the Zodiack, from the beginning of Aries, vnto the true place of the Moone.

7. The middle longitude of the Moone from the Sunne, is the arch of the Zodiack, from the middle place of the Sunne Eaſtwards vnto the middle place of the Moone.

8. And this arch doubled, is called the doubled longitude of the Moone from the Sunne, or the center of the Moone (as the *Alphonſines* call it) which is nothing elſe but the arch of the Zodiack, betweene the place of the *Apogæum* of the Eccentrick and the

middle place of the Moone. It is called the doubled longitude of the Moone from the Sunne, becauſe it is alwayes twice ſo much, as is the middle longitude of the Moone from the Sunne.

9. And it is called the center of the Moone, becauſe it ſheweth the diſtance of the center of the Moones Epicycle from the *Apogæum.*

10. The equation, or *Proſthaphæreſis* of the center, is the arch of the Epicycle, betweene the middle and true *Apogæum* of the Epicycle.

This equation or *Proſthaphæreſis*, is nothing at all, when the center of the Epicycle is in the *Apogæum*, or *Perigæum* of the Eccentricke. But the Epicycle being in any other part of the Eccentricke there is alwaies ſome equation of the center, yet in ſome parts thereof, where it groweth greateſt, it is 13. degr. 9. minutes: and ſo long as the center of the Epicycle, is in the halfe of the Eccentrick deſcending from the *Apogæum* to the *Perigæum*, that equation is to be added to the motion of the Epicycle; but in the other halfe of the Eccentricke aſcending, it muſt be ſubtracted; that ſo the true Argument or Anomaly of the Epicycle may be had.

11. The Argument, or Anomalie of the Moone is nothing els, but the motion of the Moones Epicycle.

12. The true or middle argument, or Anomalye, is the arch of the Epicycle from the true or middle *Apogæum* of the Epicycle, vnto the center of the body of the Moone, reckoned that way, which the epicycle moueth.

13. The equation of the argument, or *Proſthaphæreſis* of the epicycle, is the arch of the Zodiack, be-

betweene the middle, and true place of the Moone. This equation is nothing, when the Moone is in the true *Apogæum*, or *Perigæum* of her epicycle. But it is greateſt, when the center of the Moone commeth to a line drawne out of the center of the world, and touching the epicycle, which is in the *Perigæum* of the eccentrick.

And the Moone being in the firſt, that is in the Weſt halfe of the Epicycle deſcending from the true *Apogæum* thereof, the middle place of the Moone goeth before the true place, and the equation of the argument muſt therefore be ſubtracted: but when the Moone is in the other latter, and Eaſterly ſemicircle of the epicycle, the true place goeth before the middle place, and ſo that equation muſt be added to the Moones middle motion, that the true motion and place of the Moone may be found.

CHAP. XV.

The reaſon of the variety of the Moones equation, &c.

THis equation becommeth leſſe or greater, according as the epicycle is further off, or nearer to the center of the world. The leaſt equations are, when the epicycle is in the *Apogæum* of the eccentricke, and contrarywiſe, the greateſt muſt happen, the epicycle being in the *Perigæum* of the eccentricke.

The difference betweene theſe greateſt, and leaſt Equations, *Ptolemee* and *Copernicus* call the exceſſe: but *Purbachius*, and the *Alphonſines*, call it the diuerſitie of the Diameter; becauſe that difference of the equations ariſeth by reaſon of the diuerſe apparent bigneſſe of the diameter of the Epicycle, according as it is nearer to vs, or further from vs.

Therefore in the Aſtronomicall tables, they vſe to ſet downe thoſe equations onely, which happen when the Epicycle is in the *Apogæum* of the eccentrick, which are the leaſt equations, whereto they alſo adioyne the exceſſe, or diuerſity of diameter, ſhewing how much thoſe equations, which happen when the Epicycle is in the *Perigeum* of the Eccentrick, exceed thoſe which happen, the epicycle being in the *Apogeum* of the eccentrick. Moreouer, there are annexed certaine min. which they call *Scrupula*, or *minuta proportionalia*; that is, proportionall minutes; whereby is found, how much of the ſayd exceſſe, is to be added to the foreſayd equations, when the epicycle is in any other part of the eccentrick, then in the *Apogæum*: that ſo the true equation of the argument, for the ſame part of the eccentrick might at any time be found. For then onely is that whole exceſſe to be added, when the epicycle is in the *Perigæum* of the eccentrick. But if the epicycle be in any other part of the eccentrick; then looke what proportion 60. hath to the whole exceſſe, the ſame proportion haue the proportionall minutes, anſwerable to that part of the eccentrick, wherein the epicycle is, vnto the part proportional of the exceſſe, which (part proportionall) being added to the equation before found, ſhall giue you the true equation.

Chap. XVI.

The reaſon of the Moones proportionall minutes, &c.

THe reaſon of thoſe proportionall minutes, may in ſome ſort be ſhewed, by thoſe concentricall arches of circles, which you ſee drawne vppon the Moones eccentricall Orbe, in this Sphære: but in-deed all thoſe arches muſt bee vnderſtood, to haue alwayes the ſame center with the world, and not to be moued about togither with the Eccentrick. The vppermoſt of them is to be drawne by the center of the Epicycle being in the *Apogæum* of the Eccentrick, and the nethermoſt is drawne by the ſame center when it is in the *Perigæum* of the Eccentrick: ſo as the diſtance of theſe two arches, or Peripheryes, is iuſt twiſe ſo much as the eccentricitie; that is the diſtance of the center of the Eccentrick, from the center of the world, ſhewed by the diſtance of the ſhort lines N O, or F F, vppon the Orbe carying the *Apogæum*; or of P Q, or G H, vpon the caryer of the *Perigæum* of the Moone.

The whole diſtance, between theſe two peripheries, from the vttermoſt to the innermoſt, is vnderſtood to be deuided into 60. equall parts, imagining euery one of theſe to contayne 10. as may appeare by the figures ſet to euery one of them, from the vppermoſt to the nethermoſt, in this order: 10.20.30.40.50.60.

Now the interſections of theſe *Peripheries* with the Eccentrick (that is) with the vppermoſt of the two deuided *Peripheries*, which are drawne round about through the midſt of the Moones eccentricall Orbe) do ſhew what proportionable min. anſwer to any part of the eccentrick, after this manner. In the vppermoſt of the two foreſaid graduated *peripheries*, looke that diſtance of the center of the moones Epicycle from the *Apogæum* of the Eccentrick, (that is to ſay) that doubled longitude of the Moone as the *Alphonſines*

To finde the Moones proportionall minutes.

call it) which you deſire: Then looke which of the conſentricall arches before mentioned paſſeth by the the terme, or end of that diſtance or doubled longitude: And thirdly, looke about in the ſame arch, what number is ſet thereuppon, for that ſheweth you the number of the proportionall minut. anſwerable to the ſcituation of the Epicycle, at that diſtance from the *Apogæum* of the Eccentrick.

What the proportionall minutes of the Moone are.

Theſe proportionall min. therfore may be defined to be nothing elſe, but the ſixtieth parts of the diuerſity of diameter, or of the exceſſe wherwith the equations of the argument, or *Proſtaphæreſis*, of the Epicycle are to be augmented when the Epicycle is any other part of the Eccentrick, then in the *Apogæum*.

Otherwiſe alſo, theſe proportionall min. may be defined, to be ſixtieth parts of the exceſſe, wherewith the line drawne from the center of the earth, to the *Apogæum* of the Moones Eccentrick, exceedeth the line drawne from the ſame center to the *Perigæum* of the Eccentrick: For theſe ſixtieth parts alſo may not vnfitly be called proportionall min. becauſe that alwaies looke how many of theſe parts there are left without the circumference of the Eccentrick, or beyond the center of the Epicycle; ſo many of the former ſixtieth parts of the diuerſity of diameter, or of the exceſſe of the *Proſtaphæreſes* of the Epicycle, muſt be added to the Equation of the argument, that the true equation of the argument may bee had, for that poſition, or ſeituation of the Epicycle, in the Eccentrick.

CHAP. XVII.

The reaſon of the Eclipſes of the Sunne and Moone, &c.

NOw by this Sphere, it may eaſily be conceiued, why there is not an Eclipſe, in euery coniunction or oppoſition of the Sunne and Moone. For ſeeing that the Moone hath for the moſt part a greater apparent latitude, then the viſible or apparent conioyned ſemediameters of the Sunne and Moone in the coniunction: and becauſe the true latitude of the Moone, is alſo for the moſt part greater then the apparent ſemediameters of the Moone and ſhadow of the earth (at that place where the Moone ſhould paſſe through that ſhadow) in the oppoſition, to make an Eclipſe: it commeth to paſſe, that in moſt coniunctions and oppoſitions of the Sunne and Moone, there is no Eclipſe. And the reaſon hereof is this, becauſe that the Moone commeth vnder the way of the Sunne (which wee call the Ecliptick line) onely twiſe in a moneth, and thoſe 2. points (wherin the wayes of the Sunne and Moone croſſe each other) onely twiſe in a ſynodicall moneth, which two points wee called the Dragons head and taile; whereof wee haue alſo ſpoken before,) Wherfore, ſeeing the Sunne (going but once only through the compaſſe of the Ecliptick in a yeare) can come but once in a yeare to eyther of thoſe points, the Moone for the moſt part, when ſhe cōmeth to bee in oppoſition, or coniunction with the Sun, muſt needs be ſo farre wide from the Ecliptick line, or way of the Sunne, either towards the North or South: that ſhe can neither come betwixt vs and the Sun in the coniunction, nor yet within the compaſſe of the ſhadow of the earth in the oppoſition.

But when the Sunne commeth neare eyther of thoſe points (which hapneth once in ſix moneths (there muſt needs for the moſt part be ſome Eclipſe, eyther of the Sunne or Moone, or both.

CHAP. XVIII.

Of the diuerſity of the bounds or ſpaces, within which an Eclipſe may happen: and the reaſon of that diuerſity.

THe bounds or diſtances from the Dragons head or taile, within which there may happen an Eclipſe of the Moone, are ſometimes greater and ſometimes leſſe, by reaſon of the diuers diſtances of the Sunne, or Moone, or both of them, from the earth. For ſeeing the body of the Sunne is greater then the globe of the whole earth (as it is manifeſtly demonſtrated by *Ptolemee* and *Copernicus*) it muſt needs be, that the greater diſtance the Sun hath from the earth, the greater ſhadow muſt the earth haue; and the nearer the Sunne is to the earth, the leſſe ſhadow ſhall the earth haue, at the place of the Moons paſſage through the ſhadow, at equall diſtances from the earth.

Contrariwiſe, the further that the Moone is from the earth, the leſſe ſhall the ſhadow of the earth be, and the nearer the Moone is to the earth, the greater ſhall the ſhadow be, at the place where the Moone is to paſſe through the ſhadow.

The greateſt diſtance therefore from the Dragons head or taile, wherein there can at any time happen any Eclipſe of the Moone, is about .13. degrees. And the leaſt diſtance at which it is poſſible for the Moone to auoid an Eclipſe, is about 10. degr. and one third part of a degree; which hapneth when the Moone is in the *Apogæum* of her Epicycle, in her greateſt diſtance from the earth, and the Sunne in his *Perigæum*, in the time of his greateſt eccentricity, for then the Sunne commeth neareſt to the earth and maketh the leaſt ſhadow: as contrarywiſe at the ſame time of his greateſt eccentricity, beeing in his *Apogæum*, he hath his greateſt diſtance from the earth, and ſo maketh the earth caſt forth her greateſt ſhadow. At which time, if the Moone alſo chance to be in the *Perigæum* of her Epicycle, and ſo in her neareſt diſtance from the earth, ſhe may be ſomething Eclipſed, although ſhe be full 13. degrees or ſomething more from the Dragons head or taile.

CHAP. XIX.

How to find the place of the Dragons head and taile for any time.

NOw the place, and time of the full Moone, being eaſily knowne by ſome Almanack, or Prognoſtication; it ſhall not be hard, to giue a reaſonable neare eſtimate, and to foretell both the time, and quantity of the Eclipſe of the Moone, the place of the Dragons head and taile, being firſt knowne after this manner.

The place of the Dragans head, being firſt giuen for any time, for euery yeare before the ſame time, adde to the ſame place: and for euery yeare after the ſame time ſubtract 19. degrees and one third part of a degree and for euery moneth a degree and an halfe and a tenth part of a degree and for euery day 3. minutes and the remainder ſhall ſhew you the place of the Dragons head after the ſame time: or the ſumme before

fore that time without any great errour.

As for example, The 30. of Iune this preſent yeare 1600. ſuppoſe you would know the place of the Dragons head: The place therefore of the Dragons head being firſt giuen, for the beginning of the ſame yeare, in 0. degree 45. minutes, of *Aquarius*: and ſix moneths onely of that yeare being paſſed, I take for thoſe ſix moneths *6*. degrees and *6*. halfe degrees that is *9*. degrees and ſixteenth parts of a degree that is *36*. min. the ſumme of all which is *9*. degrees and *36*. minutes.

Which being ſubtracted out of 0. degree, 45. minutes of *Aquarius*, there remaine 21. degrees *9*. min. of *Capricorne*, for the place of the Dragons head at that time.

CHAP. XX.

A table for finding the place of the Dragons head and taile more exactly and the declaration thereof.

BVt if you would haue the place of the Dragons head more exactly, you may find the ſame moſt eaſily, by meanes of the table following, for any time within the ſpace of theſe 20. yeares, yet to come.

This table conteyneth three principall parts or columnes, the firſt part ſheweth you in what ſigne, degr. and min. the Dragons head is, at the beginning of any yeare, from this preſent yeare 1600. till the yere 1620. The ſecond part ſheweth how much the Dragons head moueth, in any number of moneths of the yeare: the third part giueth you the motion of the Dragons head, in any number of dayes of the moneth.

At the beginning of the yeares of our Lord,

The place of the Dragons head.

Yeare.	Sign.	Deg.	Mi.
1600	*Aquarius*	0	45
1601	*Capricorn*	11	21
1602	*Sagittar.*	22	2
1603	*Sagittar.*	2	42
1604	*Scorpio*	13	22
1605	*Libra*	23	59
1606	*Libra*	4	39
1607	*Virgo*	15	19
1608	*Leo*	25	59
1609	*Leo*	6	35
1610	*Cancer*	17	15
1611	*Gemini*	27	55
1612	*Gemini*	8	35
1613	*Taurus*	19	12
1614	*Aries*	29	52
1615	*Aries*	10	32
1616	*Piſces*	21	12
1617	*Piſces*	1	49
1618	*Aquarius*	12	29
1619	*Capricorn*	23	9
1620	*Capricorn*	3	49

Moneths Complete.	De.	Mi.
Ianuary	1	38
February	3	8
March	4	46
Aprill	6	22
May	8	0
Iune	9	36
Iuly	11	14
Auguſt	12	53
Septemb.	14	28
October	16	7
Nouemb.	17	42
Decemb.	19	21

Day	De.	Mi.
1	0	3
2	0	6
3	0	10
4	0	13
5	0	16
6	0	19
7	0	22
8	0	25
9	0	29
10	0	32
11	0	35
12	0	38
13	0	41
14	0	44
15	0	48
16	0	51
17	0	54
18	0	57
19	1	0
20	1	4
21	1	7
22	1	10
23	1	13
24	1	16
25	1	19
26	1	13
27	1	26
28	1	29
29	1	32
30	1	35

To

CHAP. XXI.

To finde the place of the Dragons head or tayle, by the former table.

Finde out in the former table, the moneth next going before the moneth giuen; finde out alſo the day of the moneth, Adde together the numbers of degrees and minutes anſwerable to that moneth and day of the moneth, and ſubtract the ſame out of the place of the Dragons head at the beginning of the yeare, adding thereto 30. degr. (that is the whole ſigne next going before reſolued into degr.) if the Sunne aforeſayd be greater then the number of degr. ſhewing the place of the Dragons head at the beginning of the yeare: ſo ſhall you haue the place of the Dragons head for the time giuen. And the point of the Zodiack oppoſite to this, is the place of the Dragons taile.

Take for example, The 29. of Nouember 1601. I find therefore againſt October (the moneth going next before Nouember) 16. degrees 7. minutes and againſt the 29. day 1. degree 32. minutes, the ſumme of both theſe added together is 17. degrees 39. min. the place of the Dragons head for the beginning of the yeare 1601. is 11. deg. 21. min. of *Capricorne*, which becauſe they be leſſe then 17. deg. 39. min. I adde vnto them 30. deg. that is the whole ſigne of *Sagittarie*, and the ſumme of both is 41. deg. 21. min. out of which ſubtract 17. deg. 39. min. and there ſhall remaine 23. deg. 42. minutes of *Sagittarie*; the place of the Dragons head at that time. And the point of the Zodiacke which is oppoſite hereto (that is the 22 degrees 42. minutes of *Gemini*) is the place of the Dragons tayle.

CHAP. XXII.

To know at what time there ſhall be an Eclipſe of the Moone.

THe place of the Dragons head being thus knowne, finde out the ſame place vpon the horizon of the Sphære, and ſee what day and moneth anſwereth thereto: finde out alſo the place of the full Moone, which hapneth next before or after that day, which place if it chance to bee within 11. or 12. deg. eyther before or after that point of the Zodiack which is oppoſite to the Dragons head, there muſt needs be for the moſt part an Eclipſe of the Moone.

Likewiſe if you finde what day and moneth is anſwerable to the place of the Dragons taile vpon the horizon of the Sphære if the place of the full Moone which happeneth next before or after that day chance to be within 11. or 12. degrees of the Dragons head, for the moſt part there ſhall bee an Eclipſe of the Moone.

As for example, The 20. of Ianuarie laſt this preſent yeare 1609. the place of the Dragons head was found (by the former Chapter) to haue beene in 29. deg. 41. min. of *Capricorne*; whereto there anſwereth in the horizon the 10. day of Ianuarie the place of the full Moone hapning next after, vpon the 20. of the ſame moneth in the morning muſt needs be in the place oppoſite to the place of the Sunne the ſame 20. day: Therefore becauſe the Sun that day is in 9. deg. and about one halfe of *Aquarius*, therefore the place of

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SPHAERE.

Deuided into three principall Parts.

WHEREOF

The firſt intreateth eſpecially of the Circles of the vppermoſt moueable SPHÆRE,
and of the manifold vſes of euery one
of them ſeuerally.

The ſecond ſheweth the plentifull vſe of the
vppermoſt Sphære, and of the Circles
thereof joyntly.

The third contayneth the Deſcription of the
Orbes whereof the Sphæres of the Sunne and
Moone haue beene ſuppoſed to bee
made, with their Motions
and Vſes.

By EDVVARD WRIGHT.

*The Contents of each Part are more particularly ſet
downe in the Table.*

LONDON,
Printed by [illegible] A. and *T. Fawcet*, for *Iohn Tap*, and are to bee
ſold at his Shop at S. *Magnus* corner,
1627.

CHAP. XIIII.

The definitions of certayne Aſtronomicall wordes of Art, for the better vnderſtanding of the Theoricke of the Moone.

1. THe line of the Moones middle motion, is a line vnderſtood to be drawne from the center of the earth, by the center of the Moones Epicycle, vnto the Zodiack.

2. This line ſheweth the middle place of the Moon in the Zodiack.

3. And the middle motion of the Moone, is the arch of the Zodiack, from the beginning of Aries, vnto the ſame line.

4. So likewiſe the line of the true motion, or of the true place of the Moone, is drawne from the center of the world, by the center of the Moone, to the Zodiack.

5. This line therefore ſheweth the true place of the Moone in the Zodiack.

6. And the true motion of the Moone, is the arch of the Zodiack, from the beginning of Aries, vnto the true place of the Moone.

7. The middle longitude of the Moone from the Sunne, is the arch of the Zodiack, from the middle place of the Sunne Eaſtwards vnto the middle place of the Moone.

8. And this arch doubled, is called the doubled longitude of the Moone from the Sunne, or the center of the Moone (as the *Alphonſines* call it) which is nothing elſe but the arch of the Zodiack, betweene the place of the *Apogæum* of the Eccentrick and the

middle place of the Moone. It is called the doubled longitude of the Moone from the Sunne, becauſe it is alwayes twice ſo much, as is the middle longitude of the Moone from the Sunne.

9. And it is called the center of the Moone, becauſe it ſheweth the diſtance of the center of the Moones Epicycle from the *Apogæum*.

10. The equation, or *Proſthaphæreſis* of the center, is the arch of the Epicycle, betweene the middle and true *Apogæum* of the Epicycle.

This equation or *Proſthaphæreſis*, is nothing at all, when the center of the Epicycle is in the *Apogæum*, or *Perigæum* of the Eccentrick. But the Epicycle being in any other part of the Eccentricke there is alwaies ſome equation of the center; yea in ſome parts thereof, where it groweth greateſt, it is 13. degr. 9. minutes: and ſo long as the center of the Epicycle, is in the halfe of the Eccentrick deſcending from the *Apogæum* to the *Perigæum*, that equation is to be added to the motion of the Epicycle; but in the other halfe of the Eccentricke aſcending, it muſt be ſubtracted; that ſo the true Argument or Anomaly of the Epicycle may be had.

11. The Argument, or Anomalie of the Moone is nothing els, but the motion of the Moones Epicycle.

12. The true or middle argument, or Anomalye, is the arch of the Epicycle from the true or middle *Apogæum* of the Epicycle, vnto the center of the body of the Moone, reckoned that way, which the epicycle moueth.

13. The equation of the argument, or *Proſthaphæreſis* of the epicycle, is the arch of the Zodiack,

betweene the middle, and true place of the Moone. This equation is nothing, when the Moone is in the true *Apogæum*, or *Perigæum* of her epicycle. But it is greateſt, when the center of the Moone commeth to the line, drawn out of the center of the world, and touching the epicycle, when it is in the *Perigæum* of the eccentrick.

And the Moone being in the firſt, that is in the Weſterly halfe of the Epicycle, counted from the true *Apogæum* thereof, the middle place of the Moone goeth before the true place, and the equation of the argument muſt therefore be ſubtracted: but when the Moone is in the other latter, and Eaſterly ſemicircle of the epicycle, the true place goeth before the middle place, and ſo that equation muſt be added to the Moones middle motion, that the true motion and place of the moone may be found.

CHAP. XV.

The reaſon of the variety of the Moones equation, &c.

THis equation becommeth leſſer or greater, according as the epicycle is further off, or nearer to the center of the world. The leaſt equations are, when the epicycle is in the *Apogæum* of the eccentrick, and contrarywiſe, the greateſt muſt happen, the epicycle being in the *Perigæum* of the eccentrick.

The difference betweene theſe greateſt, and leaſt Equations, *Ptolemee* and *Copernicus* call the exceſſe: but *Purbachius*, and the *Alphonſines*, call it the diuerſitie of the Diameter; becauſe that difference of the equations ariſeth by reaſon of the diuerſe apparent bigneſſe of the diameter of the Epicycle, according as it is nearer to vs, or further from vs.

Therefore in the Aſtronomicall tables, they vſe to ſet downe thoſe equations onely, which happen when the Epicycle is in the *Apogæum* of the eccentrick, which are the leaſt equations, whereto they alſo adioyne the exceſſe, or diuerſity of diameter, ſhewing how much thoſe equations, which happen when the Epicycle is in the *Perigæum* of the Eccentrick, exceed thoſe which happen, the epicycle being in the *Apogæum* of the eccentrick. Moreouer, there are annexed certaine min. which they call *Scrupula*, or *minuta proportionalia*: that is, proportionall minutes: whereby is found, how much of the ſayd exceſſe, is to be added to the foreſayd equations, when the epicycle is in any other part of the eccentrick, then in the *Apogæum*: that ſo the true equation of the argument, for the ſame part of the eccentrick might at any time be found. For then onely is that whole exceſſe to be added, when the epicycle is in the *Perigæum* of the eccentrick. But if the epicycle be in any other part of the eccentrick; then looke what proportion 60. hath to the whole exceſſe, the ſame proportion haue the proportionall minutes, anſwerable to that part of the eccentrick, wherein the epicycle is, vnto the part proportional of the exceſſe, which (part proportionall) being added to the equation before found, ſhall giue you the true equation.

CHAP. XVI.

The reaſon of the Moones proportionall minutes, &c.

THe reaſon of thoſe proportionall minutes, may in ſome ſort be ſhewed, by thoſe concentricall arches of circles, which you ſee drawne vppon the Moones eccentricall Orbe, in this Sphære: but indeed all thoſe arches muſt bee vnderſtood, to haue alwayes the ſame center with the world, and not to be moued about togither with the Eccentrick. The vppermoſt of them is to be drawne by the center of the Epicycle being in the *Apogæum* of the Eccentrick, and the nethermoſt is drawne by the ſame center when it is in the *Perigæum* of the Eccentrick: ſo as the diſtance of theſe two arches, or Peripheryes, is iuſt twiſe ſo much as the eccentricitie; that is the diſtance of the center of the Eccentrick, from the center of the world, ſhewed by the diſtance of the ſhort lines N O, or F F, vppon the Orbe carying the *Apogæum*; or of P Q, or G H, vpon the caryer of the *Perigæum* of the Moone.

The whole diſtance, between theſe two peripheries, from the vttermoſt to the innermoſt, is vnderſtood to be deuided into *60.* equall parts, imagining euery one of theſe to contayne 10. as may appeare by the figures ſet to euery one of them, from the vppermoſt to the nethermoſt, in this order: 10.20.30.40.50.*60.*

Now the interſections of theſe *Peripheries* with the Eccentrick (that is) with the vppermoſt of the two deuided *Peripheries*, which are drawne round about through the midſt of the Moones eccentricall Orbe) do ſhew what proportionable min. anſwer to any part of the eccentrick, after this manner: In the vppermoſt of the two foreſaid graduated *peripheries*, looke that diſtance of the center of the moones Epicycle from the *Apogæum* of the Eccentrick, (that is to ſay) that doubled longitude of the Moone as the *Alphonſines* call

To finde the Moones proportionall minutes.

call it) which you deſire: Then looke which of the conſentricall arches before mentioned paſſeth by the the terme, or end of that diſtance or doubled longitude: And thirdly, looke about in the ſame arch, what number is ſet thereuppon, for that ſheweth you the number of the proportionall minut. anſwerable to the ſcituation of the Epicycle, at that diſtance from the *Apogæum* of the Eccentrick.

What the proportionall minutes of the Moone are.

Theſe proportionall min. therfore may be defined to be nothing elſe, but the ſixtieth parts of the diuerſity of diameter, or of the exceſſe wherwith the equations of the argument, or *Proſtaphareſis*, of the Epicycle are to be augmented when the Epicycle is any other part of the Eccentrick, then in the *Apogæum*.

Otherwiſe alſo, theſe proportionall min. may be defined, to be ſixtieth parts of the exceſſe, wherewith the line drawne from the center of the earth, to the *Apogæum* of the Moones Eccentrick, exceedeth the line drawne from the ſame center to the *Perigæum* of the Eccentrick: For theſe ſixtieth parts alſo may not vnfitly be called proportionall min. becauſe that alwaies looke how many of theſe parts there are left without the circumference of the Eccentrick, or beyond the center of the Epicycle; ſo many of the former ſixtieth parts of the diuerſity of diameter, or of the exceſſe of the *Proſtaphareſes* of the Epicycle, muſt be added to the Equation of the argument, that the true equation of the argument may bee had, for that poſition, or ſcituation of the Epicycle, in the Eccentrick.

CHAP.

CHAP. XVII.

The reaſon of the Eclipſes of the Sunne and Moone,&c.

NOw by this Sphere, it may eaſily be conceiued, why there is not an Eclipſe, in euery coniunction or oppoſition of the Sunne and Moone. For ſeeing that the Moone hath for the moſt part a greater apparent latitude, then the viſible or apparent conioyned ſemediameters of the Sunne and Moone in the coniunction: and becauſe the true latitude of the Moone, is alſo for the moſt part greater then the apparent ſemediameters of the Moone and ſhadow of the earth (at that place where the Moone ſhould paſſe through that ſhadow) in the oppoſſition, to make an Eclipſe: it commeth to paſſe, that in moſt coniunctions and oppoſitions of the Sunne and Moone, there is no Eclipſe. And the reaſon hereof is this, becauſe that the Moone commeth vnder the way of the Sunne (which wee call the Ecliptick line) onely twiſe in a moneth, and thoſe 2. points (wherin the wayes of the Sunne and Moone croſſe each other) onely twiſe in a ſynodicall moneth, which two points wee called the Dragons head and taile; whereof wee haue alſo ſpoken before,) Wherfore, ſeeing the Sunne (going but once only through the compaſſe of the Ecliptick in a yeare) can come but once in a yeare to eyther of thoſe points; the Moone for the moſt part, when ſhe cōmeth to bee in oppoſition, or coniunction with the Sun, muſt needs be ſo farre wide from the Ecliptick line, or way of the Sunne, either towards the North or South: that ſhe can neither come betwixt vs and the Sun in the coniunction, nor yet within the compaſſe of the ſhadow of the earth in the oppoſition.

But when the Sunne commeth neare eyther of thoſe points (which hapneth once in ſix moneths (there muſt needs for the moſt part be ſome Eclipſe, eyther of the Sunne or Moone, or both.

Chap. XVIII.

Of the diuerſity of the bounds or ſpaces, within which an Eclipſe may happen: and the reaſon of that diuerſity.

THe bounds or diſtances from the Dragons head or taile, within which there may happen an Eclipſe of the Moone, are ſometimes greater and ſometimes leſſe, by reaſon of the diuers diſtances of the Sunne, or Moone, or both of them, from the earth. For ſeeing the body of the Sunne is greater then the globe of the whole earth (as it is manifeſtly demonſtrated by *Ptolemee* and *Copernicus*) it muſt needs be, that the greater diſtance the Sun hath from the earth, the greater ſhadow muſt the earth haue; and the nearer the Sunne is to the earth, the leſſe ſhadow ſhall the earth haue, at the place of the Moons paſſage through the ſhadow, at equall diſtances from the earth.

Contrariwiſe, the further that the Moone is from the earth, the leſſe ſhall the ſhadow of the earth be, and the nearer the Moone is to the earth, the greater ſhall the ſhadow be, at the place where the Moone is to paſſe through the ſhadow.

The greateſt diſtance therefore from the Dragons head or taile, wherein there can at any time happen any Eclipſe of the Moone, is about 13. degrees. And the leaſt diſtance at which it is poſſible for the Moone to auoid an Eclipſe, is about 10.degr. and one third part of a degree; which hapneth when the Moone is in the *Apogæum* of her Epicycle, in her greateſt diſtance from the earth, and the Sunne in his *Perigæum*, in the time of his greateſt eccentricity, for then the Sunne commeth neareſt to the earth and maketh the leaſt ſhadow: as contrarywiſe at the ſame time of his greateſt eccentricity, beeing in his *Apogæum*, he hath his greateſt diſtance from the earth, and ſo maketh the earth caſt forth her greateſt ſhadow. At which time, if the Moone alſo chance to be in the *Perigæum* of her Epicycle, and ſo in her neareſt diſtance from the earth, ſhe may be ſomething Eclipſed, although ſhe be full 13. degrees or ſomething more from the Dragons head or taile.

CHAP. XIX.

How to find the place of the Dragons head and taile for any time.

NOw the place, and time of the full Moone, being eaſily knowne by ſome Almanack, or Prognoſtication; it ſhall not be hard, to giue a reaſonable neare eſtimate, and to foretell both the time, and quantity of the Eclipſe of the Moone, the place of the Dragons head and taile, being firſt knowne after this manner.

The place of the Dragans head, being firſt giuen for any time, for euery yeare before the ſame time, adde to the ſame place: and for euery yeare after the ſame time ſubtract 19. degrees and one third part of a degree and for euery moneth a degree and an halfe and a tenth part of a degree and for euery day 3. minutes and the remainder ſhall ſhew you the place of the Dragons head after the ſame time: or the ſumme before

fore that time without any great errour.

As for example, The 30. of Iune this preſent yeare 1600. ſuppoſe you would know the place of the Dragons head: The place therefore of the Dragons head being firſt giuen, for the beginning of the ſame yeare, in 0. degree 45. minutes, of *Aquarius*: and ſix moneths onely of that yeare being paſſed, I take for thoſe ſix moneths 6. degrees and 6. halfe degrees that is 9. degrees and ſixteenth parts of a degree that is 36. min. the ſumme of all which is 9. degrees and 36. minutes.

Which being ſubtracted out of 0. degree, 45. minutes of *Aquarius*, there remaine 21. degrees 9. min. of *Capricorne*, for the place of the Dragons head at that time.

CHAP. XX.

A table for finding the place of the Dragons head and taile more exactly and the declaration thereof.

BVt if you would haue the place of the Dragons head more exactly, you may find the ſame moſt eaſily, by meanes of the table following, for any time within the ſpace of theſe 20. yeares, yet to come.

This table conteyneth three principall parts or columnes, the firſt part ſheweth you in what ſigne, degr. and min. the Dragons head is, at the beginning of any yeare, from this preſent yeare 1600. till the yere 1620. The ſecond part ſheweth, how much the Dragons head moueth, in any number of moneths of the yeare: the third part giueth you the motion of the Dragons head, in any number of dayes of the moneth.

At the beginning of the yeares of our Lord,

The place of the Dragons head.									
Yeare	*Sign.*	*Deg.*	*Mi.*	*Moneths Complete.*	*De.*	*Mi.*	*Da.*	*De.*	*Mi.*
1600	*Aquarius*	0	45	*Ianuary*	1	38	1	0	3
1601	*Capricorn*	11	21	*February*	3	8	2	0	6
1602	*Sagittar.*	22	2	*March*	4	46	3	0	10
1603	*Sagittar.*	2	42	*Aprill*	6	22	4	0	13
1604	*Scorpio*	13	22	*May*	8	0	5	0	16
1605	*Libra*	23	59	*Iune*	9	36	6	0	19
1606	*Libra*	4	39	*Iuly*	11	14	7	0	22
1607	*Virgo*	15	19	*Auguſt*	12	53	8	0	25
1608	*Leo*	25	59	*Septemb.*	14	28	9	0	29
1609	*Leo*	6	35	*October*	16	7	10	0	32
1610	*Cancer*	17	15	*Nouemb.*	17	42	11	0	35
1611	*Gemini*	27	55	*Decemb.*	19	21	12	0	38
1612	*Gemini*	8	35				13	0	41
1613	*Taurus*	19	12				14	0	44
1614	*Aries*	29	52				15	0	48
1615	*Aries*	10	32				16	0	51
1616	*Piſces*	21	12				17	0	54
1617	*Piſces*	1	49				18	0	57
1618	*Aquarius*	12	29				19	1	0
1619	*Capricorn*	23	9				20	1	4
1620	*Capricorn*	3	49				21	1	7
							22	1	10
							23	1	13
							24	1	16
							25	1	19
							26	1	13
							27	1	26
							28	1	29
							29	1	32
							30	1	35

CHAP. XXI.

To finde the place of the Dragons head or tayle, by the former table.

FInde out in the former table, the moneth next going before the moneth giuen; finde out allſo the day of the moneth, Adde together the numbers of degrees and minutes anſwerable to that moneth and day of the moneth, and ſubtract the ſame out of the place of the Dragons head at the beginning of the yeare, adding thereto 30. degr. (that is the whole ſigne next going before reſolued into degr.) if the Sunne aforeſayd be greater then the number of degr. ſhewing the place of the Dragons head at the beginning of the yeare: ſo ſhall you haue the place of the Dragons head for the time giuen. And the point of the Zodiack oppoſite to this, is the place of the Dragons taile.

Take for example, The 29. of Nouember 1601. I find therefore againſt October (the moneth going next before Nouember) 16. degrees 7. minutes and againſt the 29. day 1. degree 32. minutes, the ſumme of both theſe added together is 17. degrees 39. min. the place of the Dragons head for the beginning of the yeare 1601. is 11. deg. 21. min. of *Capricorne*, which becauſe they be leſſe then 17. deg. 39. min. I adde vnto them 30. deg. that is the whole ſigne of *Sagittarie*, and the ſumme of both is 41. deg. 12. min. out of which ſubtract 17. deg. 39. min. and there ſhall remaine 23. deg. 42. minutes of *Sagittarie*; the place of the Dragons head at that time. And the point of the Zodiacke which is oppoſite hereto (that is the 23.

degrees 42. minutes of *Gemini*) is the place of the Dragons tayle.

Chap. XXII.

To know at what time there ſhall be an Eclipſe of the Moone.

THe place of the Dragons head being thus knowne, finde out the ſame place vpon the horizon of the Sphære, and ſee what day and moneth anſwereth thereto: finde out alſo the place of the full Moone, which hapneth next before or after that day, which place if it chance to bee within 11. or 12. deg. eyther before or after that point of the Zodiack which is oppoſite to the Dragons head, there muſt needs be for the moſt part an Eclipſe of the Moone.

Likewiſe if you finde what day and moneth is anſwerable to the place of the Dragons taile vpon the horizon of the Sphære if the place of the full Moone which hapneth next before or after that day chance to be within 11. or 12. degrees of the Dragons head, for the moſt part there ſhall bee an Eclipſe of the Moone.

As for example, The 20. of Ianuarie laſt this preſent yeare [illegible] the place of the Dragons head was found (by the former Chapter) to haue beene in 29. deg. 42. min. of *Capricorne*, whereto there anſwereth in the horizon the 10. day of Ianuarie the place of the full Moone hapning next after, vpon the 20. of the ſame moneth in the morning muſt needs be in the place oppoſite to the place of the Sunne the ſame 20. day. Therefore becauſe the Sun that day is in 9. deg. and about one halfe of *Aquarius*, therefore the place of the full Moone ſhall bee in 9. degrees and about one halfe of the ſigne oppoſite to *Aquarius*, that is of *Leo*; becauſe it is within leſſe then 11. degrees of the Dragons tayle (for the Dragons tayle is in the 29. degrees 41. minutes of *Cancer*, that is, in the place oppoſite to the Dragons head, being in the 29. degrees 41. minutes of *Capricorne*,) therefore there was at that time an Eclipſe of the Moone: Alſo becauſe the place of the Moone, the ſame day at noone, was about 12. degrees and one halfe of *Leo*; that is, about 3. degrees more then at the time of the full Moone eclipſed; it may hereby appeare, abating for euery degree two houres, that the midſt of the Eclipſe was about *6*. of the clocke in the Morning.

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FINIS.